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(1920-22)

ANNUAL REPORT

OF THE

Association of Dominion Land Surveyors

TOGETHER WITH THE

PAPERS READ AT THE

Thirteenth Annual Meeting

HELD AT

OTTAWA

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on the 4th, 5th and 6th February 1920.

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F. V. SEIBERT, D.L.S.

THIRTEENTH ANNUAL MEETING.

The Thirteenth Annual Meeting of the Association of Dominion Land Surveyors was held at the Ottawa Public Library, February 4th, 5th, and 6th, 1920.

The following is a list of those who were present at the opening session or at some other time during the continuance of the meeting:—

Members present:—

Dr. Deville, I.S.O., Dr. Otto Klotz, C. A. Magrath, W. J. Stewart, P. B. Symes, J. R. Akins, C. F. Aylsworth, H. G. Barber, T. H. Bartley, F. W. Beatty, G. A. Bennett. C. A. Bigger, G. H. Blanchet, W. J. Boulton, E. P. Bowman, A. J. Brabazon, E. F. Browne, S. Bray, L. Brenot, M. G. Cameron, H. W. Cannell, A. S. Cram, W. Christie, R. F. Clarke, M.C., T. H. G. Clunn, M. F. Cochrane, J. M. Cote, G. C. Cowper, J. D. Craig, P. W. Currie, W. P. Daly, T. A. Davies, E. M. Dennis, W. M. Dennis, G. B. Dodge, C. Engler, T. Fawcett, D.T.S., S. D. Fawcett, O. S. Finnie, G. H. Ferguson, M. C., E. F. Gorman, A. O. Gorman, F. D. Henderson, J. Hardouin, A. H. Hawkins, C. P. Hotchkiss, G. H. Herriot, Major E. W. Hubbell, J. A. S. King, F. H. Kitto, H. F. J. Lambart, P. M. H. LeBlanc, G. J. Lonergan, J. E. Lyon, C. S. Macdonald, W. L. MacIlquham, E. S. Martindale, J. J. McArthur, M. D. McCloskey, T. A. McElhanney, K. F. McCusker, P. J. McGarry, M. Meikle, J. B. Milliken, G. A. Mountain, W. C. Murdie, M. C., A. M. Narraway, Major D. H. Nelles, W. H. Norrish, N. J. Ogilvie, H. Parry, J. H. Patterson, P. E. Palmer, A. M. Perry, J. W. Pierce, R. C. Purser, T. H. Plunkett, J. L. Rannie, D.T.S., C. Rinfret, F. W. Rice, D. F. Robertson, F. V. Seibert, H. L. Seymour, T. Shanks, P. A. Shaver, A. C. T. Sheppard, A. G. Stewart, A. D. Stewart, J. J. Stock, M.C., C. M. Teasdale, W. M. Tobey, D.T.S., B. W. Waugh, G. H. Watt, A. H. Whitcher, W. R. White, E. J. Wight, J. G. Wright.

Others present:—

Colonel Anderson, Thomas Adams, F. M. Allan, J. H. Byrne, G. A. Colquhoun, J. P. Cordukes, E. F. Drake, J. F. Fredette, W. C. Gillis, W. J. Lytle, W. E. Morgan, A. H. Miller, H. P. Moulton, T. S. Nash, Hon. A. Meighen. Hon. Dr. Roche, J. Smith, W. A. Spence, C. C. Smith, A. S. Thomas, P. N. Johnson, W. H. Herbert, A. J. Elder, J. D. Bradley, R. M. Cram, H. E. Sutherland, C. W. Besserer, W. L. Miskell, E. Burnett, D. E. Chartrand, R. Douglas, D. B. Dowling, C. E. Jones, J. H. Hawes, W. A. Johnston, T. W. Dwight, J. G. Mitchell, Col. Houliston, Major McLaurin, J. B. Challies, R. M. Motherwell, H. G. Rhoades, H. Claughton-Wallin, Major Cochrane, H. J. Bedard, R. Callander, E. E. D. Wilson, N. A. Thompson, M.C., E. W. Harrison, R. O. Spreckley, M.C., D E. Campbell, M. J. Carroll, E. C. Rochon, J. P. McMillan, W. B. Armstrong, H. E. Hayward, B. R. Hooper, J. E. May, T. E Brown, W. J. Peaker, H. K. Carruthers, G. S. Jones, H. R. Cram, H. J. Dunlop, M.C., W. J. Moule, R. Dawson, G. H. D. Gibson, W. R. Burrill, and many others.

Wednesday, February 4th,—Morning Session.

The meeting was called to order by the President, Mr. J. R. Akins. who called on the Secretary-Treasurer to read the minutes of the last Annual meeting.

MR. HENDERSON: The minutes of the last Annual meeting are fully recorded in the Annual Report, which has been distributed to all the members. I move. therefore, that the minutes as recorded there be accepted and approved.

The motion was seconded by Mr. S. D. Fawcett, and carried.

The President addressed the meeting as follows:

President's Address.

"It is with great pleasure that I welcome you to this our 13th Annual Convention. I am very pleased to see so many of our members and I am sure that we will have a pleasant and profitable time. We regret very much the loss by death, of two of our esteemed members, Mr. W. A. Scott and Mr. J. E. Sirois.

I wish to thank you for the honour you have conferred upon me by electing me as your President for the past year. The office carries with it grave duties and responsibilities as well as pleasure and honour. I am proud to be President of this Association. I am proud of the Dominion Land Surveyors who carried on the work before the Association was formed and who laid a solid foundation on which our Association and traditions are formed. Tradition is a wonderful thing. What was it that made the British navy so much superior to the German navy. It was not her ships, it was not her guns. but her men upholding the traditions of their forefathers. There may be many casualties but there is always enough of the old salt to flavor the new drafts and the soul and spirit of the navy lives on. So let us uphold the traditions of determination, resource, efficiency and initiation that we have inherited. One of our late members said to me with great pride," I never turn back."

The past year has been a year of great progress for our Association. and I believe that it has never been in as healthy a condition. The spirit of the individual members was always good but there is more enthusiasm and more of a spirit of co-operation, more unity of purpose. It is not my intention to dwell long on our profession. I will only give some ideas on the general outlook of the profession, on the general progress that is being made, and then I will deal with other subjects.

Surveyors are given too much to looking at their own work, of considering their own profession. They do not give much consideration to other professions or occupations of mankind. They are in danger of becoming narrow. They have been in too much of a rush in the past. Most of them work for the government, and in the past they have received their instructions in the spring often none too early to avail themselves of the ice and snow which is necessary to enable them to reach the scene of operations. They rapidly gathered a party without taking much time for selection or choice. They made a dash for the field and by the mercy of God they got there. While in the field their days were occupied with such strenuous labor, that at night they were too tired to read or think. It was then a scramble to get the work done before the frost and snow put an end to operations and when they returned they had lost touch with, and too often interest in, the events that are transpiring outside their own little sphere. They have a reunion with their families and by the time they have got sufficiently acquainted to call each other by their first names, they were called to the field again. These conditions were caused by the great demand for land for settlement when the tide of immigration was at its height and under these conditions how could anyone expect a surveyor to consider the idealism of the profession or to develop into a Kant or a Swedenbourg ? Spenser was an engineer, but the times must not have been so strenuous when he practiced his profession.

We hope that this rush is over. That the surveyor will have more leisure in practicing his profession and carrying out his work so that he may be able to give more time to observing. I do not mean observing Polaris, but observing the conditions surrounding his work, keeping constantly in mind the development of this wonderful country, the making of it more habitable for our people and future generations and the best manner and means of extracting from nature all her stores. He should have time for reading and reflection so that he may keep himself posted on what is done the world over in this regard.

The surveyor is in a position to become an authority on the natural resources of the country and the policy that should be followed in their development. It is from the ranks of our profession that that great corporation, the C. P. R., selected two of its most highly paid men; men who could give them first hand information on their own natural resources, and of the natural resources of Canada. There are also other men who are holding high positions of responsibility and they got their training as Dominion Land Surveyors. We should all aspire to become authorities of equal or greater importance. Emerson says, "Hitch your waggon to a star and the Gods will do your work."

Not only should a surveyor train his observing powers, he should also develop his literary talent. He should record all he observes and afterwards write it up with great care. What is the use of a man having a great amount of knowledge or experience if he is not able to impart it to others or convince them that he has it. Our duty in this life is not to obtain knowledge for ourselves or seek our own pleasure, but to do our part to add to the sum total of human knowledge, to fill our niche in the general evolution of things, and if possible, to make this world a better place because of our having lived in it, and all other things being equal the man who has a good command of English will far outstrip him who has not. This is a thing that many surveyors lack, and the nature of the profession is not conducive to its development. We should therefore place special emphasis on it. There is no man who should arrive at more sound conclusions than a surveyor. He is generally removed from the thickly populated centres and is not therefore subject to mob psychology or influence by the subtle wave forces of the minds of others. His conclusions are arrived at by reading and quiet reflection, unhampered by outside influence, and the first problems that demand his special attention are how to make more accessible to the people the wealth of our soil, the wealth of our minerals, the wealth of our forests and the wealth of our waters, for on these the development, prosperity and life of the nation depend.

Now what is the future outlook for our profession ? The outlook is as wide as our mental horizon. The profession is what we will make it. Canada has great areas of fertile lands, mountains of minerals, great stretches of forest, and 40% of the water power of the world. We have enormous deposits of coal but our water is more valuable. The coal will in time become exhausted but the ''white coal'' derived from our water powers is inexhaustible. With it we can fertilize our agricultural lands from the air, we can reduce our minerals, manufacture the products of our forests, and supply vast industries. When we consider those things who would dare to place a limit on the future greatness of Canada, and it is no strain on the imagination to see what part surveyors should and will play in this development.

The meaning of the word survey is not limited to the laying out of legal boundaries or the erection of monuments. It has a far wider application, but first considering the future in this field the surveying of legal boundaries, and erection of monuments. The end of that work has been by no means reached. There must be a complete Geodetic system extending from coast to coast. There is an enormous amount of levelling to be done and not half of our lands has yet been surveyed. It is true, that most of our agricultural lands as it is generally called, have been subdivided, but there are vast areas that have not yet been traversed by transit and chain and these are likely to come into their own. Mr. Stefansson says that there is vast wealth to be derived from these lands in the form of reindeer and musk ox meat, so we may yet be subdividing the barren lands into large caribou, reindeer and musk ox farms. Oils and minerals are almost certain to be found and developed in the north which will also make a demand on the surveyor. In the rush of the past, inaccuracies crept into the surveying operations and the work was done in too much hurry to allow time for the erection of very permanent monuments. So that to save much trouble and litigation for future generations a re-survey should be made of the northwest and permanent monuments established. This should be done as soon as possible so that use might be made of any original monuments that are still in existence, before they are entirely obliterated. Now if we consider surveying in a wider view, what is there to be done ? Here the surveyors must use all their initiative powers. There are reclamation schemes to be suggested and carried out and there is land classification to be made. There is room for improvement in our system of land tenure. Our homestead system is not a perfect one for the classification of the lands suitable for profitable agriculture is an important consideration that has not been considered in the making of our homestead laws. Our system of land tenure should be made to prevent thousands of acres of fertile lands from being retained in an idle condition by speculators and as the future of Canada primarily depends on agriculture a scientific investigation of the soil should be made so that an intelligent direction may be given to settlement and a proper use made of the soil by the settler.

There is the demand for community settlement which is based on the principle that agricultural workers deserve an even chance with the manufacturing workers; and, as with factories, so with the farms—they should be equipped for work before operations begin.

There is also the field of road making and town planning, both of which will give great benefits to all. With all these needs of the people to be met and all this work to be done, this body of trained and thinking men will surely give an account of itself. This organization is not on the decline but we have to accept our responsibilities and get our shoulders to the wheel.

So much for our own profession, now let us for a short time cease to be land surveyors and survey the problems that are perplexing the millions of mankind. The three great problems are, the social, the industrial, and the financial. We will not discuss the first but leave it to the reformer and the church; but if you will bear with me a while I would like to make a few remarks on the last two. They directly affect surveyors and every other member of society.

The financial situation in the United States is good but in Europe it is serious and some solution must shortly be found for if financial ruin is not frustrated by credits and starvation averted by the importation of foodstuffs, much of central Europe will become a festering sore which is bound to spread over the whole world. Because of the rapid means of communication, any political or economical disease cannot be confined to the country of its origin. The world is undergoing an intellectual revolution; but may we prevent a political revolution with all its accompanying disaster and ruin. The argument that we are helping industrial rivals in the race by loaning them money is a fallacy. One nation cannot continue to prosper if all others are in poverty. The interest and trade of the world is so much interlaced and interdependent that greatest prosperity will come to each when all are prospering.

We in Canada are not in as good a position financially as our neighbors to the south. For while they have lowered their national debt about $800,000,000 during the past year we have increased ours by $600,000,000. But we are in a much better position than Europe, and while we have had a poor harvest and scarcity of fodder in many parts of the West and none too good crops in the East, yet the balance of trade is largely in our favour. Not with the United States as is shown by our exchange but with foreign countries. The trouble is we are selling our own goods on credit, and consequently have not got money to pay our own debts, but money is fairly plentiful and generally easily obtained. There is little distress except to those who are working for a fixed salary or who have only a limited income to depend on. But we are sure to have difficult times ahead. The histories of all wars have been that there has been a period of great prosperity directly following the war during the period of reconstruction followed by a period of great depression, when taxation will be a heavy burden.

Our national debt by the end of March will be nearly two billion dollars. Where is the money to come from to meet the interest of this colossal sum ? We must cease to borrow, for by doing that we are mortgaging the future and following the example of the man who tried to raise himself over a fence by lifting on his boot legs. The money will have to be raised by taxation. We will be taxed and taxed until our very memory will be taxed. We must develop more independence as a nation and cease sending to other countries for goods that we should make ourselves,or for their exports. Our boys demonstrated on the fields of France that in the art of war Canadians are second to none. Let us show to the world that we can do the same in the arts of peace. Our only solution is to lower the cost of high living and to produce. Economy and production must be the national watchword.

At the beginning I stated that this has been a year of progress, for our Association, but I am sorry to say that it has been one of great disappointment for the world. The year will have few mourners, it has been a year of disappointed hopes and frustrated ideas. At the beginning we expected to have peace and we looked forward to settling down to work again and hoped that we would soon be back to pre-war conditions. We said, ''Peace, Peace,'' but there was no peace. Instead we have our neighbors refusing to sign the peace treaty but are making it a matter for base partnership and sordid contention until from a nation that boasted of its solidarity and unity during the war, it is distracted and torn asunder by party strife. It is to-day perhaps, suffering more from politics than from radicalism. We have the dark cloud of war in the east which threatens to envelop the world. We have the bitter strife between Labor and Capital which is paralysing the nations. and then there is the Irish question in which Ireland is trying to entangle the world. In fact the whole world appears to have turned into Irishmen, everyone is either fighting or agitating.

We are living in troublesome times. The stars from heaven are falling. old and supposedly stable governments have gone; crowns and thrones have fallen, old customs and institutions have been swept away. The very foundation of Civilization has been shaken and the end is not yet. Who would dare predict what will happen in the next decade ?

Count Akuma, one of the oldest, ablest and most experienced of the statesmen of Japan, watching the mighty struggle from the other side, stated that it meant nothing less than the death of European Civilization. Let us hope that his prophesy will not come true, but the outlook is dark enougt

Many urge the passing of laws curtailing personal liberty under the idea that freedom of speech and the freedom of the press is taken advantage of by the dissolute and dangerous and that the majority of the people may be contaminated by their doctrines; but this might lead to a worse condition. We might lose the liberty that our forefathers fought for. Bacon says, ''Concerning the materials of sedition it is a thing well to be considered for the surest way to prevent sedition (if the times do bear it) is to take away the matter of them, for if there be fuel prepared it is hard to tell whence the spark will come that shall set it on fire.'' Therefore, every grievance real or imaginary, should be allowed to be aired freely without interference. Milton had the truth when he said, "Though all the winds of doctrine were let loose to play upon the earth, so truth be in the field, we do injury by licensing and prohibiting, to misdoubt her strength. Let her and falsehood grapple; whoever knew truth put to the worst in a free and open encounter ? Her confuting is the best and surest suppressing."

But as the present situation has resulted from the most stupendous calamity the world has ever experienced we can hardly expect immediate relief. Democracy has triumphed over Autocracy, and we must look upon our troubles as the growing pains of Democracy. Mr. Gompers was right when he said "If we set out expecting to solve any of the real industrial problems within the span of our short lives, we are doomed to disappointment. The problems are ages old and can only be solved as human nature becomes more perfect, less selfish and ignorant, and we abolish class, religious and racial prejudices."

The question of vital interest to us is, where is our position in the present scheme of things ? We cannot remain neutral or we will be crushed between the upper and nether stone. What are we to do ? What are others in a similar position doing ?

At a recent meeting of Bank clerks in Toronto, 98% of those present voted in favor of affiliating themselves with the American Federation of Labor. The Bank clerks of Hamilton and Montreal have taken a similar action. At present the British Medical profession is at odds about affiliating themselves with the trade union movement, and I understand that the American Engineers last spring voted in favor of attaching themselves to the Union Ranks. It might be wise for us to do the same and again it might not, I am not very clear in my own mind on the subject. It does not seem a professional thing to do, but self preservation compels us to do many things we would not otherwise do. One thing I am clear on, that there must be a closer union between all technical men in the engineering profession. The Association of Alberta Land Surveyors has sent a delegate to our meeting for the purpose of finding out whether we would be in favor of a union of all surveyors in Canada. This is commendable but should we not go further ? It will leave it to you to consider.

Finally gentlemen, there is no better advice that I can give you in these troublesome times than that which was given by St. Paul nearly two thousand years ago, "Quit yourselves like men and be strong."

I thank you for your attention.

MR. HERRIOT : We have all listened, I am sure, with a great deal of pleasure to the address of our President. Speaking as a member of the Executive of the Association, I can say truthfully that during the last year the President has done his very best to further the interests of the Association. His interests have been our interests; the welfare of our organization and of our profession has been his first consideration in every case. We were extremely fortunate last year in our choice of President; and I feel that I voice the sentiment of every one here when I say that his efforts are deeply appreciated. (Applause.)

THE CHAIRMAN: I thank you, gentlemen, for your expression of appreciation. We will now have the report of the Secretary-Treasurer.

Report of Secretary-Treasurer.

The Executive Council elected under the new Constitution and By-laws adopted at the Annual Meeting, January 1919, consisted of a President, a Vice-President, a Secretary-Treasurer and sixteen Councillors. Twenty-four Council meetings were held during the year. The highest attendance at a meeting was 10; the lowest 6; the average 7.5.

One of the first matters taken up was the question of how to deal with members in arrears. Section 31 of the Constitution provides that when a member is more than two years in arrears his name shall be struck from the roll, but Council took the view that it was advisable to give a little time and the time was accordingly extended to July 1st. Notices were sent out and on July 1st, all who were more than two years in arrears of fees were struck from the rolls. The number so dropped was 45. This did not include any member who had been on Military Service. The membership then stood at 208.

In March, Council approved of a letter to the Minister drawing attention to certain aspects of the newly formed Reclamation Service which vitally affect Dominion Land Surveyors. This letter was printed and a copy sent to each member.

On Mar. 24 a Professional meeting was held in the Carnegie Library Hall at which Mr. Thomas Adams gave an address on Rural Planning and Development. Mr. Adam's address, and a summary of the discussion was printed and distributed to the members.

On April 9 the tender of Dadson-Merrill & Co. for printing 500 copies of the Annual Report at $1.70 per page was accepted.

At the meeting on April 25 the Council decided to co-operate with the Engineering Institute of Canada in an effort to secure better recognition for technical men throughout the country. A memorandum on the subject was prepared, printed and distributed to the members.

In June the attention of Council was drawn to a Bill which was going through the House. This was Bill 95—The Soldier Settlement Act of 1919—and clause 49 of the Bill was held to contravene the D.L.S. Act. The clause reads as follows:

"The Board may empower any person duly licensed or empowered to act as a surveyor for any Province of Canada or any engineer, to make any survey or establish any boundary and furnish the plans and descriptions of any land acquired or to be acquired by the Board for the execution of any of the purposes of this Act."

A committee was appointed to call on the Soldier Settlement Board with a view to having the clause amended at the Second reading. The following amendment was suggested:

"The Board may employ in the survey of any Dominion lands acquired by the Board any duly qualified Dominion Land Surveyor and in the survey of other lands may employ any Provincial Land Surveyor duly qualified for the Province in which such lands are situated, to make any survey or establish any boundaries and furnish plans and descriptions of any land acquired or to be acquired by the Board for the execution of the purposes of this Act."

It was found, however, that no change was made.

When the New Classification of the Civil Service came out in June it was thought that it would be interesting to members who were in the field to know what was being done and by orders of the Council extracts from the Classification book were printed and distributed.

In September an advertisement appeared in the Canada Gazette from the C.S. Commission for a technical clerk for the Topographical Surveys Branch who must be a Dominion Land Surveyor. Salary $1260. Council considered this salary so inadequate that a letter was prepared and sent to members calling their attention to the cost of living in Ottawa and to the wages paid to different classes of workmen here. It is interesting to note that the C.S. Commission did not receive a single answer to their advertisement and that the position is still vacant.

Membership

On January 1st, 1919, the membership stood as follows:

Honorary members	8
Active members	244

During the year the following changes took place:—

Members struck off for non-payment of fees as provided in section 31 of the Constitution and By-laws	45
New members	13
Resigned	3
Died	2

On December 31st, 1919, the membership stood as follows:—

Honorary	8
Active members	207

CORRESPONDENCE

During the year eleven circular letters were sent to members. Two of these were in regard to fees, and were sent to only a part of the membership.

The other nine were for the information of the members in regard to some matters of interest and were sent to all the members.

Three hundred and eighty-eight letters were received and dealt with.

REPORTS

Five hundred Copies of the Annual Report for 1919—the 12th Report—were received and disposed of as follows:—

Members	190
Complimentary	41
Advertisers	15
Ontario Land Surveyors Association	130
Saskatchewan Surveyors Association	12
Alberta Surveyors Association	6
British Columbia Surveyors Association	6
Quebec Surveyors Association	1
Sold	1
On hand	80
Miscellaneous	18
	500

One hundred Copies of the Report of the O.L.S. Association were received and distributed to our members who are not Ontario Land Surveyors.

FINANCIAL STATEMENT

January 1st, 1919, to December 31st. 1919.

Receipts.

Balance from 1918	$363.49	
Fees Received	260.40	
Advertisements	97.88	
Sale of Annual Reports	1.15	
Government Grant	125.00	
Sale of Luncheon Tickets	58.00	
Interest	8.53	
Premium on American cheque	.12	
		$914.57

Expenditures

Caretaker at Carnegie Library	$ 4.00	
Transfers and Express	3.40	
Luncheon at Chateau Laurier	87.45	
Exchange, Stamps, etc	1.95	
Typewriting	3.50	
Advertisements of Meetings	3.52	
Printing Annual Report	336.60	
Printing and Stationery	67.80	
Honorarium to Secretary	75.00	
Reporter at Annual Meeting	72.00	
Flowers for funeral of W. A. Scott, D.L.S.	8.00	
		663.22
Balance		251.35

Assets

Bank Account as of December 31st, 1919	$235.05	
Cash on hand	16.30	
		251.35
Accounts Outstanding:—		
For Advertisements in Annual Report	$12.00	
" Annual Reports sold	4.50	
		16.50
Total		$267.85

Audited and found correct.
E. M. DENNIS
S. D. FAWCETT

January 26th, 1920.

MR. SEIBERT: I do not know what jurisdiction the Dominion has over legislation enacted by the provinces, but it would seem to me that the provision referred to by the Secretary as incorporated in the Soldier Settlement Act, 1919, is in entire contradiction to the Provincial Land Acts of Alberta, Saskatchewan and Manitoba. Should we not direct the attention of the Provincial Association to the fact that this Act has gone through ? I am sure that the Association in Alberta has no knowledge of it.

MR. McELHANNEY: Are the words "duly qualified" in that Act ?

MR. HENDERSON : "Duly licensed". The clause says:

> "The Board may employ any person duly licensed or empowered to act as a surveyor for any province of Canada or any engineer."

MR. McELHANNEY : Is there such a thing as a "licensed engineer" anywhere in Canada ? Does the Act give any definition of "engineer"—whether he is to be a stationary or a civil engineer ?

MR. S. D. FAWCETT : When was that Act passed ?

MR. HENDERSON : The old Expropriation Act goes away back into the eighties. We went to see the gentleman who drafted the Soldier Settlement Act with regard to the matter, and then made out a written statement of our case which we sent to Mr. Maber, Secretary of the settlement Board, but no change was made.

MR. SEIBERT : Aside from the steps which the Secretary mentions as having been taken was any legal advice obtained ?

THE CHAIRMAN : No.

MR. SEIBERT : Then I move that the Secretary be authorized to obtain legal advice with regard to the legislation mentioned, with a view to seeing whether it conflicts with the Dominion Lands Surveys Act; and that a copy of this Act be sent to the Secretaries of all Provincial Land Surveyors' Associations.

MR. PIERCE : I second the motion. I may mention that the Ontario Land Surveyors' Association has retained legal advice right along for the purpose of watching legislation that goes through the Provincial House affecting land surveyors.

MR. HAWKINS : This is a very important matter, and I do not think that the Association should rush into it without very mature consideration. The secretary has told us that our funds on hand amount to about $200; if we retain legal advice that amount will be eaten up very quickly. Before we take any action of that kind we should make provision to meet the expense. I suggest that this motion be allowed to stand until we deal with the question of fees; we shall then be in a much better position to consider it.

THE CHAIRMAN : No increase of fees can be made effective until a year from now, because notice has to be given of the proposed change in the constitution. We cannot let this matter stand in the meantime; we do not know how it might be dealt with a year from now. It must be dealt with right away.

MR. SEIBERT : I am quite willing to allow the motion to stand until Friday.

MR. PIERCE : I am quite satisfied to have the matter left over for a day or two, but I do not think that it should be shelved simply because we may not have the money to pay legal services.

THE CHAIRMAN : We might have to subscribe personally to a fund for that purpose.

MR. PIERCE : I would be in favour of personal subscriptions. But I am not sure that legal advice will cost so much as some of us seem to think. It is possible that the Department of Justice would give us some information or assistance.

MR. HAWKINS : A friend of mine who is a lawyer in the House brought the question up there and it was admitted that anybody could make these surveys; under the Act as it stands he did not require to be a land surveyor or to have a commission. So that so far as legal advice goes, to my mind that settles the matter. This member took the matter up with the Minister; and if you get Hansard of that date you will find that the Minister said: "Oh well, the Settlement Board are not going to go outside of the surveyors". This is a very disadvantageous position for land surveyors to be in.

MR. R. F. CLARKE : I should think that we should get legal advice as to which of these Acts holds good. If the two are on the Statute Book one would think that the earlier Act would have precedence.

MR. BOULTON : The Department of the Interior has a legal officer; why not refer the matter to him ?

THE CHAIRMAN : Did the member of Parliament to whom Mr. Hawkins refers say that this latter Act was contradictory to previous Acts ?

MR. HAWKINS : No.

THE CHAIRMAN : That is the point we want to have settled.

MR. NORRISH : Did the Secretary not say that the Expropriation Act was passed in 1882 and that it is still in force ?

MR. HENDERSON : Yes.

MR. NORRISH : Is there the shadow of a doubt then, that the Expropriation Act takes precedence over the Dominion Lands Surveys Act and probably all Provincial Acts as well ?

MR. McELHANNEY : In the case of the British Columbia Land Surveyors' Corporation, the Government have precedence over the Corporation in the matter of appointing persons to make surveys. That is, if the British Columbia Land Surveyors' Corporation take any action that would interfere with the carrying on of the work as the Government think it should be carried on, the Government can make appointments over the head of the Corporation; they can appoint any person they like. They threatened to do that in 1911.

MR. HERRIOT : Is there anything on record to show that the Expropriation Act has been applied and that ordinary engineers have been called in to make surveys, determine boundaries, and so on ? If so, we know that that Act has been fully made use of for the benefit of the engineer as well as of the surveyor. If, however, there is nothing of that kind on record, we know that that clause of the Act was never used in that way, and possibly we expect the Board to keep within proper limits in this regard.

MR. CLARKE : A couple of years ago a law suit arose out of a dispute whether certain Cobalt mining lands should be surveyed by surveyors employed by the mines or by Ontario Land Surveyors. If I remember correctly, the result was favorable to the Ontario Land Surveyor. I do not know whether or not the Expropriation Act came in here; probably the jurisdiction was entirely provincial.

MR. HERRIOT : That is a somewhat different case. Practically all railway plans, in the West, at any rate, must be signed by land surveyors. The surveys may not be executed by a land surveyor; it may be carried on by the engineers on the staff, but as long as the surveyor signs that plan as his own official work it is accepted.

THE CHAIRMAN : The motion will stand over until Friday, when it may be taken up under the head of unfinished business.

The next item on the programme is new business. I may say that we have with us to-day Mr. A. G. Stewart, D.L.S., as a delegate from the Alberta Land Surveyors' Association.

MR. STEWART : At the annual meeting of the Alberta Land Surveyors' Association held in Edmonton last January the following resolution was unanimously adopted: "Resolved, that this Association send a representative to the Annual Meeting of the Dominion Land Surveyors' Association to press the claims of Surveyors generally to a higher classification and rate of pay than that now assigned to them by the Civil Service Commission and that the reasonable expenses of such representative be paid out of the general funds of the Association."

From the above it is evident that the members of that Association are sincere in their convictions that the surveying profession in Canada has not the recognition or status which it rightly deserves and that the members of that profession should protest and endeavor in every honorable way to establish it in its proper place.

It would be difficult for anyone to point out all of what might be called the injustices from which the profession now allows itself to suffer, but I might point out an instance or two.

In the Lands Titles or Registry Office in British Columbia several draftsmen are employed examining plans for registration, etc. They receive the official title of Surveyor and a salary of about $1200 per year. To anyone not posted on the matter it is misleading.

In one instance I understand that that particular misleading information was used by another province in classifying qualified Land Surveyors in their employ. In another province plans to be registered in the Land Titles Office were examined and approved by a man who had not even the qualifications of an articled pupil and who signed himself "Assistant Surveyor to the Land Titles Office." In another province the official files show that the Government is aware that the Surveyors have referred to the living conditions under which they are compelled to work as "A Dog's Life." In an advertisement issued by the Civil Service Commission sometime ago we find that a Dominion Land Surveyor is offered an annual salary of $1260.

The above are a few instances where the public are absolutely misled as to what class of work the members of the profession really do.

Some explanations have been offered by surveyors themselves of the cause of this condition, but I have never heard it said that our standard of education is not high enough; that the profession attracts a poor class of Canadians; or that the class of work which we are called upon to perform is technically or physically easy or of little importance. The above could not truthfully be said. The popular explanation for existing conditions which I have often heard is that the Surveyor, of necessity, spending so much time in the field, cannot take a part in the many social, business, and political institutions which we have established in all parts of the Dominion, and therefore is not prominent enough in the public eye. Although it is possible for a Surveyor engaged on field work to take a part in such institutions it is a fact that he does not. As an instance I may mention that there are over twenty Surveyors resident in Edmonton and organized in the city there are organizations such as the Board of Trade, Rotary Club, Kiwanis Club, to say nothing of Hospital and other charitable Boards, and I do not know of one Surveyor who is a member of any of them. It is a fact that the Surveyors are not prominently in the public eye in that particular way, but I don't believe that we can establish that fact as the reason for our present status. This explanation is offered by ourselves and is in reality not a weakness in our profession but in our attitude. As a matter of fact there is no reason why we should not have the recognition which most of us think we deserve. But it is not reasonable to suppose that such recognition will be thrust upon us by those outside our profession even if we joined all the public-spirited clubs in Canada.

It is not done in this age of keen competition where every class of worker using brain or muscle is too busy boosting his own particular trade or profession. For instance, what interest do the Surveyors take in advancing the welfare of the legal, dental or medical professions, yet we all have the greatest admiration for those professions and believe that the high status which they enjoy is well deserved. But this recognition was not thrust upon them by those outside their respective professions. You will find that each profession worked for its recognition in a systematic way and although it required time and thought and organized effort to achieve their high status yet any member of those professions would say to-day that the result was well worth the effort. The Doctors organized many years ago under the Canadian Medical Association, the Dentists under the Dominion Dental Council and the Lawyers followed along in 1914 with the Canadian Bar Association.

Undoubtedly part of the success of our sister professions may be attributed to their splendid organization.

In our own profession we have the Dominion Land Surveyors Association, and in each Province a Provincial Association provided for by statute. They are all good and necessary institutions and the profession cannot afford to be without any of them as each one of them has a special interest to look after. However, at the present time each association deals only with questions affecting its own members. There is really no question taken up in common by all the Provincial Associations and the Dominion Association. I do not mean that what interests or affects a Provincial Surveyor does not interest or affect a Dominion Land Surveyor but that the Associations as now permanently established, most of them by statute, cannot have a broad national point of view. It is a fact that the status of a B.C.L.S. affects the status of a D. or A.L.S. When a Government undertakes to grade survey positions they base their classification on one already established. A weak or apathetic Association which fails to protect the interests of its members affects the whole profession, for such failure offsets the good done by a strong energetic association.

That which affects the surveyor working for a Government or corporation affects the Surveyor in private practice even if they are working 3000 miles apart and as individuals never heard of each other. Their interests are much the same and they probably could help each other considerably but they are members of different associations which have no connecting link and the opportunity for mutual benefit never arrives.

The different Surveyors' Associations as now established in Canada cannot very well be changed and should not be for each one serves its purpose. There are a great number of Commissioned Land Surveyors in Canada who are eligible to join only one of the existing Associations, either the Dominion or a Provincial Association. But further organization is necessary if we do not wish to be left hopelessly behind our sister professions and there should be no difficulty in obtaining that organization.

In conclusion, I have to say that I am here to assure you that the Alberta Land Surveyors' Association is keenly interested in all that affects Land Surveyors throughout the Dominion ; to impress upon you that they believe that the classification of Dominion Land Surveyors by the Civil Service Commission is unfair; and that whenever you decide the time is opportune to press your just claims to the proper authorities the Alberta Land Surveyors' Association wish to help you.

Mr. Stewart's remarks were greeted with applause.

MR. SEIBERT : We have an occasion to-day that is unique, I think, in the history of our Association. An official representative is sent here from the Alberta Land Surveyors' Association to assist and co-operate with us in bringing about a fuller recognition by the public at large and by the Civil Service Commission in particular of the services performed by the members of our profession. Two questions are definitely before us: First, that of taking up with the Civil Service Commission the matter of a just classification of members of our profession, and consequent increased renumeration for Dominion Land Surveyors. The Alberta Land Surveyors' Association assure us that they are heartily behind us. I was at their annual meeting, and I can say that Mr. Stewart has not fully expressed the spirit which has actuated the members of that body—really it cannot be adequately expressed. They are unanimously behind us in the matter; they feel that action is vital to the welfare of our profession.

Then, the second question which is before us is that of the formation of a Canadian Society of Surveyors. The Alberta Surveyors' Association at their last annual meeting committed themselves definitely to this proposal also. We should do well to recognize the spirit of co-operation that has been so generously manifested by that Association and which I am sure prevails among the other provincial associations. I would like to see more definite action taken along both the lines referred to by Mr. Stewart.

THE CHAIRMAN : Mr. Stewart has presented to us a question of some importance; the matters to which he has referred embody proposals which for some time I have thought we should back up. I would like to hear a full discussion of the subject.

MR. PIERCE: This question that Mr. Stewart has brought up is perhaps not entirely new to some of us. A year ago Mr. Akins discussed the matter with several surveyors, the idea being the formation of what he termed an Institute of Land Surveyors. The matter was introduced by the President of the Ontario Land Surveyors' Association in his address before that organization a year ago, but there was no discussion of it, and no action was taken. Our Provincial Associations and our Dominion Association are not strong enough individually to attack these problems and to see that we are accorded justice. Only this morning reference was made to the enactment of special legislation which has been put on the Statutes, legislation which is of vital concern to every surveyor in the Dominion, but the objections to which we seem powerless to overcome. Now, if an Institute could be formed which would have the combined strength of all the different Associations, Provincial and Dominion, we could certainly accomplish much more than is possible under present conditions.

There has been a disposition on the part of members of the Engineering Institute of Canada to question the eligibility of Dominion and Ontario Land Surveyors for membership in that body. They are questioning the status of Surveyors. If the application of an individual surveyor for membership in the Engineering Institute is based simply upon his experience and qualifications as a surveyor, I understand that he is not considered to be eligible for admission. There is no doubt in our minds that we are eligible; that our training is as thorough, our ability is as great, and our occupation is as important as that of any engineer. But apparently we have not been able to make the engineers believe that; so this is another matter in respect of which such a Dominion-wide Institute of land surveyors could afford us valuable assistance.

Then, there is the overlapping of work by different Departments here in Ottawa and all through the provinces. For instance, taking a case right from our own field, we have surveyors out this year making surveys, mapping out roads, revising sectional sheets, and collecting topographical information. The Militia Department also are conducting operations along practically the same lines in different sections of the country, and if these operations continue there will certainly be overlapping within a very short time. Levels are being run by the Department of Public Works, and by our own levelling department; then there are geodetic levels and railroad levels—all carried on by different organizations, but all for the same purpose. This is the result of a lack of co-ordination between these different organizations. I believe that something along the line suggested by Mr. Stewart would do much to correct many of these evils.

MR. PLUNKETT : A great deal has been said about the Dominion Land Surveyors not carrying sufficient weight as compared with other professions. It has occurred to me that the reason for that is largely because we are always associated with politics. We are classed as ordinary civil servants; and with the general public I do not believe that the civil servant carries very much weight—they have an inclination to look down on him. They think that the civil servant is making a good, easy living which has been given to him partly through charity. I may be mistaken, but that is what occurred to me. I believe that any scheme having the purpose of benefitting Provincial and Dominion Land Surveyors in this respect might better take the form of placing the whole service under a Commission independent of the Government—a Commission made up of men who would know what surveys are needed throughout the country. They could take a broad view of the matter, size up the whole situation and from their investigations arrive at a proper method of carrying out this work.

MR. NELLES : It might be well to have the surveying and engineering branches of the Government under one big engineering department, so that all this work could be co-ordinated. However, that is a big problem, and one which might be difficult to work out. As to the suggestion that an Institute of Surveyors for Canada be organized, I think the idea is a very good one; anything is beneficial that will help along lines of organization and co-ordination. As the work progresses and the purely land surveying branch of it gradually drops out, we will work more into engineering lines. I understand that the examination for Dominion Land Surveyors is going to be broadened and to include such engineering subjects as irrigation, drainage, water power development, and so on; so that in the examination itself the status of the profession will be raised.

MR. BLANCHET : Last year in connection with the reclamation Order in Council we felt the need of united action with the Provincial Associations. It was decided in a general way that the surveyor who was working in the West should, if possible, get in touch with the Provincial Associations. But the proposals were too indefinite and nothing was done. That would be a good way to accomplish something definite during the coming season. Some kind of Provincial meeting might be arranged for, to be addressed by representatives of this Association who were working in the district in question. Of course, we would have to sound each Provincial organization before we could start anything.

THE CHAIRMAN : I understand that it is Mr. Stewart's intention to visit all the Provincial Associations before he returns home.

MR. STEWART : I will read the motion that was passed at our meeting in January approving the principle of the formation of a Dominion-wide Association of Land Surveyors and providing the necessary machinery for action in the matter:

"RESOLVED :

(1) That in the opinion of this Association it is desirable in the interests of our profession that a Dominion wide Association of Land Surveyors be formed for the purpose of better protecting and advancing the interests and promoting its good and welfare.

(2) That a committee of this Association be appointed by the President to enter into communication with the various surveyors' associations throughout Canada for the purpose of organizing such association.

(3) That the said committee be empowered to do all acts necessary to advance the formation of such association with power in connection with a committee or committees from all or some of the other associations to call a general meeting of surveyors for the purpose of organizing a Canadian Association.

(4) That the Secretary of this Association be the Secretary of the said Committee."

As to the idea of a commission, suggested by Mr. Plunkett, the view of the majority at that meeting was that matters were in such an amorphous state at present and the conditions respecting organization were such that we could not take up anything of that kind and carry it out in any definite action. But benefit would undoubtedly result from the formation of an Association with standing committees on different subjects—finance, legislation, entertainment, and so on—who could meet by correspondence, if necessary, and be entrusted by the Association with certain duties.

THE CHAIRMAN : Do you propose, Mr. Stewart, to visit all the Provincial Associations before you return ?

MR. STEWART : If I have time I shall visit Toronto, Winnipeg and Regina.

MR. HERRIOT : Mr. Blanchet's suggestion is one that we might take advantage of. In nearly all the Western provinces also in Ontario and Quebec, there are men who are members of the D.L.S. Association and of some provincial organization as well. There would be nothing to prevent these men from calling a meeting of the Provincial Association and there explaining the objects of such an Institute. The meeting might not be full, but quite a number would be in attendance. I think that the project is a very favourable one and that we should proceed with the formation of such a Dominion-wide organization as soon as possible. Let us not always put the monetary consideration first. Let us have in mind first and foremost the status of our profession; the rest, may be with a little pressure, will adjust itself in time.

MR. BOULTON : I am heartily in accord with the idea of a federation of the Dominion and Provincial organizations for the betterment of our profession in general.

MR. CLARKE : I confess that I have not considered the matter at all, but I understand that others have given it consideration, yourself, Mr. Chairman, included. Have any definite plans been formulated for the carrying out of this very worthy idea ? When our members meet the Provincial Associations it would be a distinct advantage to have some definite suggestions to lay before them. Possibly Mr. Stewart may have something to say along the lines of what his Association has already considered. I feel that the more quickly we can get down to something definite on this subject the more quickly we shall achieve the result desired.

THE CHAIRMAN : What Mr. Clarke says is quite correct; beating about the bush gets us nowhere. Last spring I took the matter up but not very much interest seemed to be taken in it at that time. I talked to Mr. Cautley of Edmonton, but he didn't seem to be much interested in it. My idea at that time was that this Institute should meet in rotation in the different provinces year after year and that as many as possible from each province should attend these meetings. Possibly Mr. Stewart has worked out something still further.

MR. STEWART : Aside from the resolution which I have read, I have no suggestions to offer. The resolution covers everything. The main thing for this Association to decide is whether they are in favour of the principle. If they are in favour of it, the only thing necessary is to create some machinery for carrying it out. The resolution passed by the Alberta Land Surveyors' Association, in its second clause, provides for that machinery. It says:

> "That a committee of this Association be appointed by the President to enter into communication with the various Surveyors' Organizations throughout Canada for the purpose of organizing such Association."

I happen to be on the committee for Alberta, and we are at work now. We may have to work with the Executive Councils between the times that the different Associations meet, and we may be able to get the Executive Councils to take some action in the matter. At any rate, we could go ahead without one or two of the Associations passing any resolution at their Annual Meeting. We might find that Saskatchewan was unanimously in favour of this proposal, and we might call a conference of surveyors as provided under clause 3 of the resolution :

> "That the said committee be empowered to do all acts necessary to advance the formation of such Association, with power in connection with a committee or committees from all or some of the other Associations to call a general meeting of surveyors for the purpose of organizing a Canadian Association."

Now, we might not get the Saskatchewan men to have a meeting now and the time when we might want to call that conference; but undoubtedly we would get the Saskatchewan men to come. In passing on this proposal at your annual meeting you are not doing anything of a statutory nature; you are simply, as a body, endorsing the scheme. As an Association you will have no connection with the Institute; neither will any Provincial Association have connection with it. We might model our Association along the lines of the Canadian Bar Association. Each province has its Law Society; these organizations are similar to our Provincial Associations. It is just the same as if we formed a debating society of some kind. We shall have no statutory power; one Association will have no connection with the other. We might endorse the principle.

THE CHAIRMAN : But unless that principle is endorsed by the majority of the Associations it would be foolishness to go on with the proposal. The first thing necessary is the endorsation of the majority of the Associations.

MR. STEWART : That is what I am here for—to get you to endorse the principle.

MR. PIERCE : In order to get down to something hard and fast, I will move a resolution in the words of that which was adopted by the Alberta Association. I would suggest, however, that the executive be empowered to appoint a committee of three to take this matter up with the representatives of other Associations as suggested in the second clause of the Alberta resolution.

MR. HERRIOT : I am heartily in favour of this proposal, and possibly I would be in a position to vote on it now. But to some members the idea is practically a new one, and I think it would be unwise for us to rush through a motion for its adoption. It is true that such a motion would probably carry, but a little more time for reflection would not be amiss. We are leaving some business over for Friday morning; before then we may have a fuller opportunity for complete expression of opinion. I suggest that we leave the matter over until Friday.

MR. NELLES : I second the motion of approval.

MR. HERRIOT : We have been guilty before of rushing in and doing some unwise thing hurriedly. I belive in action, but I do not believe in making action too spontaneous. Let us have time for consideration.

MR. HAWKINS : I suggest that a committee be appointed to consider this question very carefully and to bring in a report on Friday morning. If the President name a committee of three to do this, the matter would be brought before us in a better and more mature form than we have it here. We should not rush into the thing without knowing exactly what we are going to do. I put that in the form of a motion in amendment to the main motion.

The amendment was seconded by Mr. Herriot and adopted.

THE CHAIRMAN : I name as members of this committee Mr. Seibert, Mr. Pierce and Mr. Nelles.

MR. SEIBERT : Another matter was brought up by Mr. Stewart; it is a question whether the meeting wants to deal with it or not. Do we Dominion Land Surveyors here assembled think it wise to open up the question of a more just classification in the Civil Service than we have received? Mr. Stewart was sent here primarily to assist this Association; to show us that the Alberta Land Surveyors are behind us in this matter. Their original intention in sending Mr. Stewart here was to show that we as constituents of the men who are responsible for our classification and remuneration are behind the Dominion Land Surveyors. As was pointed out by Mr. Plunkett, we Dominion Land Surveyors in Ottawa are classified as civil servants and the representatives in Parliament do not consider our vote here. The fact that the Alberta Land Surveyors and the Surveyors of the West believe that we have not received justice ought to have considerable weight with members of Parliament—or with the Civil Service Commission, as the case may be.

THE CHAIRMAN : I should like to hear some expressions of opinion as to what we should do in this matter.

MR. NELLES : An organization is being formed now of all professional men in the Civil Service, including engineers, electricians, chemists, lawyers, doctors—all who have professional standing. There are fourteen or fifteen different professional societies in Ottawa comprising members of the Civil Service, and an effort is being made to organize these into one big society, the direct purpose of which will be to look after the status of the members of those professions under the classification. This is in direct line with the formation of a Canadian Association of Surveyors. And, by the way, I would not use the word "Dominion" in the name of the new organization. In this connection there is a psychological fact to be considered. When the Canadian Society of Civil Engineers wanted to get in all the mechanical and electrical engineers there was a feeling that they wanted to make the whole thing a Canadian Society instead of having a big Association; so the other Societies were against it. If we call the new organization the "Dominion Association", there may be an impression that the Dominion Land Surveyors are doing something of that sort. I suggest that we keep the word "Dominion" out of it and use the word "Canadian".

MR. STEWART : For Mr. Nelles' information I may say that I have a draft of the proposed constitution, clause 1 of which provides that the name of the Society shall be "The Canadian Society of Land Surveyors". I should be glad to let the committee have the draft constitution, if it would be of any use to them.

THE CHAIRMAN : If there is no further discussion on this subject, I wish to point out that a motion is in order for the acceptance and adoption of the Secretary-treasurer's report.

MR. HAWKINS : I move that the report of the Secretary-Treasurer be received and adopted.

MR. SHAVER : I second the motion.

MR. McELHANNEY : I think it would be in order to say a word at this stage in appreciation of the services of our Secretary during the last year A great deal of work was done by the executive during the year, and in connection with this work the Secretary has shown unfailing zeal. I am sure that I express the sentiment of all members of the executive when I say that the work of the Secretary has been highly appreciated. |Applause).

The motion for the adoption of the Secretary-Treasurer's report was duly carried.

MR. PIERCE : I assume that we can now go back to the head of new business. The matter of our salaries, which has been brought before the meeting, has not been fully dealt with. There has been no expression from the meeting as to whether we consider our fees or the findings of the Civil Service Commission adequate, or whether we should take any action in the matter. The Alberta Land Surveyors have sent a representative here to find out what we think about it. We should come to a decision one way or the other. If the time is not proper or opportune for us to open up the matter, then we should say so, and if any other action should be taken, we ought to determine upon it.

MR. HAWKINS : I think there is no question as to the sentiment of the gentlemen present regarding the question of salary. The only thing to be done is to have something go on record that will be of some effect. A motion ought to be put on our minutes expressing dissatisfaction with the way things are at the present time. If we had a committee to investigate the matter a little further some line of action might be laid down which would be of assistance. But I think we should express ourselves as being favourable to any increase that we can possibly get.

MR. BOULTON : Too many things should not be asked for at once. The Topographical Surveyors' Society are preparing a memorandum asking for allowance increases. If we ask for too many things we may get too few. The question is what we should give the most attention to in our demands.

MR. HERRIOT: In regard to this question that we have been trying to consider, we are not able to give it any intelligent thought just at present. I doubt whether any of us has even an idea to submit as to what we should do about increase of salaries. Possibly we should leave this over until a later meeting.

THE CHAIRMAN: It only affects the field men; it does not affect the Dominion Land Surveyors who are in the inside service, because they are not classified as surveyors.

MR. NORRISH: There appears to be a slight misunderstanding. One of the field men here suggested that this was a matter for the attention of the field surveyors. Mr. Stewart points out some cases of grievances among the civil servants of Provincial Governments. As I see it, it is a matter of the status or standing of Dominion Land Surveyors, no matter by what Government they are employed. Mr. Stewart has told us that the Alberta men are ready to stand behind any action taken by the Dominion Land Surveyors' Association in this matter. It seems to me that whatever we do should be directed to the benefit of our whole membership. Anything that the Topographical Surveyors' Society may be carrying on so far as the Surveyor-General is concerned has no reference at all to the subject under discussion; we should leave it out of consideration.

MR. BOULTON: Do you not think that the Surveyor-General would have something to say about increases of salaries?

MR. NORRISH: It seems to me that the grievance must be taken up with the Civil Service Commission. The Surveyor-General may help the men who are in his employ, of course. The subject under discussion is the advancement of the Dominion Land Surveyors' profession. There are Dominion Land Surveyors in the Department of Indian Affairs, on the Geodetic staff, and so on.

MR. HAWKINS: I move that a committee be named by the President to deal with this question of remuneration and to bring in a resolution on Friday morning.

The motion was seconded by Mr. Boulton and carried.

THE CHAIRMAN: I name Mr. Hawkins, Mr. Clarke and Mr. Boulton as members of that committee.

The meeting adjourned until 2.30 p.m.

WEDNESDAY AFTERNOON SESSION.

The meeting resumed at 2.30 p.m., the President (Mr. Akins) in the Chair.

THE CHAIRMAN : The first item on our programme this afternoon is a paper on "The Soils of the Great Plains", by Mr. D. B. Dowling, of the Geological Survey. Mr. Dowling needs no introduction to this meeting; he is known as the greatest authority in Canada on the coal areas of the West, and possibly those of the East also. Of course, he is an authority on other things as well, but he is a specialist in that particular line. We shall now hear Mr. Dowling.

THE SOILS OF THE GREAT PLAINS.

By D. B. Dowling, M.A.

If the surface of the earth were a part of a perfectly rigid sphere the continents would probably have remained as groups of islands with the lowlands composed of breccia and sand, while the material of which much of the soil is made would have been carried into the sea. There is much direct evidence, however, which indicates repeated changes of level showing a certain flexibility of the crust. To this we owe the submergence of large areas during which they received a coating of the rock waste carried into the sea. Much of this rock waste, by a shifting of load or other cause, is now elevated above sea level, and underlies the great agricultural areas, so that we may say that the flexibility of the crust by providing soil for the necessary plant growth made possible the peopling of the earth other than around the fringe of the continents. In the northern part the existence of a soil does not depend altogether on this condition. The latest mantle of soil in most areas is due to the transportation of rock waste by the great continental ice sheet. This material is not, however, a soil maker of as high grade as the water borne rock deposited in lake or sea basins.

The plains of North America bear in their underlying rocks the record of long invasions of the sea and these form what seems to have been a very old feature in the history of the continent.

Much of the early history of North America is very obscure, but we know that at several periods the ocean encroached and almost submerged the continent. The maximum submergence was probably in Ordovician times, represented in Ottawa by the deposits of limestone beneath the city, the same limestones being beneath Kingston and Winnipeg. Later the seas encroaching on the continent became shallow and the deposits instead of being mostly lime gave place to muds and sands. These were better soil makers and their decay provided much of the soil for the plains of eastern America. The western plains received a much later addition of soil making material beneath a shallow muddy sea. Along the western border of this sea, the rocks were being crushed and ground in the early mountain building which preceded the final upthrust of the Rocky Mountains. Hundreds of feet of very fine grained material now somewhat hardened to shale covered the sandstones and limestones of the former plain, which stretched to the old mountains of Central British Columbia. The muddy sea being fairly shallow was very susceptible to any differential elevation, and at one time near its end as a sea it was almost emptied as the water retreated toward the Gulf of Mexico. The western border was apparently at all times a shifting one for the muds are interspersed with wedges of sandy material which by their extension eastward show the approximate amount of the uplift of the western edge, for that is where the disturbance of the crust was mainly located. During these periods of tilting, forests and marshes crept eastward, the amount of entombed vegetable matter in the present coal seams marking the length of the intervals of quiet.

The latest addition towards the building of the plains, previous to the carving of the surface, consists of a mass of coarser grained material which is not definitely sea deposit and marks not only the retreat of the sea, but a nearer source of debris than the earlier muds and sands. This was evidently due to an elevation of the area now occupied by the Rocky Mountains, which continued along with a general rise of the whole basin until its progress was halted when the areas under greater strain reached the limit of compression and the crest bent and broke along the folds. The breaks were repeated in parallel series especially in the Canadian portion near the western edge and formed the Rocky Mountain structure. This was at first probably a very high ridge of much broken and crushed soft rocks mostly sandstones, clays and shales. The carving of the plains then began and the removal of the debris and the higher part revealed the hard limestone ridges of the present mountains and the first phase of erosion might be said to include the planing of the slope from the mountains to the lowlands. Along this slope it is conceivable to suppose that much of the debris from the mountains might be scattered. As it was passed along only the harder material would survive as gravel and boulders, well rounded and reduced in size before reaching the sea.

The top of the Cypress Hills and the Hand Hills are supposed to be remnants of the old slope, and there we find a great deposit of coarse conglomerate of late Tertiary age, pointing to the probable age of the uncovering of the Rocky Mountains. With the removal during this first period of erosion of a vast quantity of material into the sea probably to the northward, the relief from the load induced a further elevation and a consequent second cycle of erosion resulted in the great scouring shown in the depression running from the vicinity of Lethbridge eastward north of the Cypress Hills and in many of the great valleys through the foothills followed generally by the present rivers.

The coming of the glacial period and the movement of the great glacier over the plains altered the general surface slightly. It probably smoothed the surface somewhat. On the melting of the ice, the deposition of its load of clay and boulders and the diversion of streams around its edge probably did more toward altering the topography than any planing action that the mass of ice had exerted.

The occupation of the sea of the valleys down the slope toward the north east, or rather the melting of the ice, which proceeded generally from the southeast, left a moving barrier which seemed to have preserved a northwest southeast front across the plains. This, as it also provided a great supply of water, not only diverted the streams to the southeast, but by the great flow of water for short intervals scoured new channels which in depth and area are comparable to the old valleys. Many lakes were formed along the ice front, forming to-day much of the fertile lands. Where the ice front paused for long periods great ridges of boulder clay were left. These form a very irregular type of topography and can be traced readily. They are not of equal value as fertile areas with the more gentle rolling lands where the surface covering was deposited in water, but from their irregularity provide more ponds for surface water and have a greater value as grazing lands. The most striking example of moraine topography is to be found in the Coteau and its continuation north of the Saskatchewan. It can be traced under different guises such as sand hills and boulder strewn hills to the Buffalo Park at Wainwright and even farther toward the bend of the Athabaska. Many of the channels cut during the period of retreat are still used and probably account for the peculiar southeast trend of many of our streams, although the direction of slope of the surface is to the northeast for most of Saskatchewan and Alberta. The streams that broke away and got into their old channels may include the two Saskatchewans and the Athabaska.

It is quite possible that the Athabaska for a time had to use the valley of Beaver River and Sturgeon River to Prince Albert, and it is pretty generally conceded that for a time the South Saskatchewan was diverted above the Elbow to the Missouri by way of the Old Wives, Willowbunch, and Big Muddy lakes, and later by way of the Souris and Qu'Appelle to the lowlands of the Manitoba plain. These diversions nearly all came by way of impounded lakes in the original valleys spilling along the ice front and the scouring of the great flood thus let loose, cutting channels which sometimes effected a complete change in the drainage. The old lake west of the Coteau was not long lived and did not complete its drainage channel. The outlet was shifted to east of the Coteau and the Regina plain became a lake basin which was drained to the southeast. Most of the outflow went by way of the Assiniboine and thus was formed the deep channel of the Qu'Appelle which finally drained the lake, leaving a large area of rich alluvium on the upland.

The melting of the ice in the lowlands of the Red River Valley created there a long lake which was not as readily drained as were others to the west, since its natural outlet was to the north and was long occupied by the ice dam. For a time this basin spilled at its southern end in Minnesota at Lake Traverse. The outlet here was maintained by a general tipping of the surface, that is, the land rose slightly at the north as the ice load was removed, until other outlets were provided either through or around the ice toward Hudson Bay. The surface then gradually fell and on the Manitoba plain its retreat is outlined by regular beaches now on dry land, the more prominent ones being on the eastern slope of the Manitoba escarpment. The C. N. Ry., from Gladstone northward along the foot of these hills is largely built along these natural embankments. Near Winnipeg a good example of an island shoal in this lake is found in a beach on the top of Stony Mountain.

The benefit of this old lake to the agricultural value of the land of the Red River Valley can hardly be measured. At one period it attained a depth over the country around Winnipeg of 560 feet and its waters received all the ground-up material obtained by the trenching of the valleys of the present Pembina, Assiniboine, Souris, and Qu'Appelle Rivers. This was deposited in the basin, most of it in the southern part, but the plains around Dauphin, Swan, and Red Deer Lakes also received a generous supply.

The question of the soils thus seems to be intimately connected with the history during glacial times. Much of the soil material carried forward in the ice was derived from the Cretaceous surface to the northeast, and the boulders from the Pre-Cambrian area beyond the Cretaceous terrace. Boulders carried by the ice from the vicinity of Cumberland lake are found near Saskatoon and have been used in the construction of the buildings of the University of Saskatchewan. The Manitoba plain is floored with the debris of the excavation of the valleys entering from the west.

THE CHAIRMAN : Mr. Dowling's paper has certainly been a very interesting one. He has dealt with his subject in clear and simple language and has thus proved the truth of the saying that art conceals art. Mr. Dowling's valuable paper will be published in our Annual Report and we shall be able to study it and obtain assistance from it in making classification of soils in our work in the field. The subject is now open for discussion.

MR. RANNIE : A month or so ago I heard a talk on the survey of an Indian village; and I thought then that these geologists must have some imagination. The same thing struck me as I listened to Mr. Dowling's talk this afternoon. What an imagination he must have had to piece together the evidence obtainable and to draw from it a history of the geological structure of the continent dating back to the days before Columbus came !

MR. NELLES : It has always struck me as peculiar that in the region of British mountains, two hundred miles north of the Arctic circle, there does not appear to have been any glacial period. There are no snow-capped mountains, no glaciers in the valleys; the winter snow melts away in the summer time. But thousands of miles to the south there are snow-capped mountains and great glaciers in the valleys. I would like Mr. Dowling to tell me why there is not a glacial period up around the British mountains.

MR. DOWLING : That is a very controversial question; it is one that is put up to the astronomers even—that of accounting for differences in climate, and so on. People even say that the earth tipped around on its axis and that the north Pole was down this way for a while. There are many different theories; I could not give any satisfactory explanation at all. Of course, the glacier did the most damage around Hudson Bay and west of that—that is, it was not a continental ice cap, as some of our forefathers use to believe; it was gradually breaking up into small fields all the time. One thing I might suggest, though: the presence of a great ice cap not only has an effect as regards temperature, but it melts moisture into the air before depositing that amount of ice. In a very dry atmosphere you can have all the glacial periods you like and you will not get any great deposit of ice; there is that point to think of too.

MR. NELLES: I have at home some maps showing the different geological conditions of the world at different times. The area around the British mountains was shown to be above the surface of the sea at the time of the glacial period, so that, if the assumption be correct, will account for the rocks not being eroded by ice.

MR. KING: In the prairies of the West we often see large boulders surrounded by quite a depression, sometimes as deep as eight feet and varying from one chain to four chains across. I should like Mr. Dowling to tell us what these are.

MR. DOWLING: These are called "Buffalo Wallows"—though I do not believe that the depressions were scoured out by the buffalo trying to rub against the boulders. I should not be surprised to know that these boulders were carried in one of the lakes that have been described. You do not find these boulders on the moraines; they are generally on the level. Now, I am not going to give you any reasons, but let me state a supposition. Suppose a chunk of ice broke away from the glacier, floated out into the water of this lake and carried a big boulder along with it. When that lake is drained the ice goes down and is deposited along with the boulder and some of the material is sifted along with it. Possibly the boulder is big enough to sink the ice when it commences to melt—the whole thing, ice and all, would sink and be buried with the rest of the material. When the ice finally melts away you have a pot-hole there, haven't you You see, pot-holes are supposed to be caused by chunks of ice melted away, leaving a hole—that is, pot-holes on the prairie. This means, then, that you have one of these sinkholes in the middle of which is your big boulder. Of course, that is only one idea of the matter. Another would be that the wind would gradually drive away the sand from around the edge of the boulder and clean it out; that explanation of course, is contingent upon the boulder being located in sand. If it was in ordinary stiff clay I would not expect that to be the case,though in time the soil might be loosened by the buffalo tramping around there and gradually carried away by the wind.

MR. T. FAWCETT: Reference has been made to the fact that the University of Saskatchewan was built of limestone brought from somewhere near Cumberland lake. I remember that while on an exploratory expedition between Churchill and Cumberland I travelled along rivers and lakes on one side of which there was limestone and on the other side granite rock, for quite a distance.

I may add that the ditches around the great boulders which have been spoken of sometimes serve a very good purpose; after a rain storm they form a good reservoir from which surveyors can obtain a plentiful supply of water.

I have found a good supply of water in these depressions possibly three weeks after the rain had come. I have always thought that these boulders had been deposited when the place was a lake. Of course, if the soil was sandy it is easy to understand that the wind storms in circling around would create these reservoirs; and as Mr. Dowling has observed possibly the soil was loosened by the tramping of the buffalo.

I have very much pleasure in proposing a vote of thanks to Mr. Dowling for his very valuable paper. (Applause).

THE CHAIRMAN: The next item is a paper by Mr. C. W. Dill, Superintendent of Highways, Saskatchewan, on "Highways in Saskatchewan". Mr. Dill himself is not present, but his paper will be read by Mr. Hawkins.

THE DEVELOPMENT AND IMPROVEMENT OF SASKATCHEWAN HIGHWAYS

C. W. Dill, Esq., M.E.I.C.

Previous to the year 1912 the improvement of roads, the building of bridges and the operation of ferries were all carried out through the Department of Public Works under the direction of the Assistant Commissioner or Deputy Minister.

The rapid settlement on the land, the great extension of steam railroads and the consequent demands on the Province for a more comprehensive road-building scheme, all combined to influence the Provincial Government with the result that, in the spring of 1912, the importance of highway improvement work was given recognition, and a commission of three members appointed to administer the work of the department. This commission took over the control of all roads, bridges, water supply, and drainage works, the ferries being left under the Public Works Department.

At that time the Government voted a grant of $5,000,000.00, for the building and improvement of roads and the erection of capital bridges, which amount was to be spent in a three years' work programme on defined road locations, approved by the Highway Commission, and organized Rural Municipalities were to assist by expending an amount of their own money equal to the Government grant for each separate location,—or what was called "the dollar for dollar basis". This work was handled by contracts with the interested Rural Municipalities, who agreed to maintain in good condition all roads improved under this programme. In unorganized sections the roads were improved by Government road crews under the supervision of District Inspectors.

As early as 1910 it was felt that the best method of assisting the Rural Municipalities was by direct money grants to be expended by them, the selection of the locations to be improved and the disposal of the money grant to remain under the approval and supervision of the Department of Public Works; and, even prior to that time, the Department adopted regulations stipulating that grants of Provincial funds should be expended chiefly upon main roads, the subordinate roads to be cared for by locally collected funds.

It was also noticed, in the older settled districts, that the people were, year after year, becoming more alive to the great advantages to them of better roads which might be travelled with comfort at all seasons of the year.

To meet this increasing demand the Government laid out a comprehensive programme of highway improvements and organized additional road crews to handle the large amount of work to be done.

In the year 1913 it was found that many more Rural Municipalities took advantage of the offer of the Highway Board to reimburse them to the extent of half the amount which they expended upon approved main roads in accordance with the regulations of the Board. This had two distinct beneficial effects; first, of stimulating the interest of each interested Municipality in it's own road-building problems, and second, in that each Municipality organized its own road crews, purchased tools and equipment, and thus became a greater or lesser factor in the efficient organization for road improvement work.

At the close of the 1913 season it was found that some of the Rural Municipalities, being anxious to have as large an amount as possible of Government moneys expended within their Municipality, expended heavily of their local funds to the extent that the burden of taxation was exceedingly great. Many Municipalities proceeded with their work without having secured the written authorization of the Board, a great deal of difficulty was experienced with the Auditing Department because accounts were not submitted in a way that was acceptable to them, and all these things combined to cause inconvenience and delays which were irritating, both to the Department and the Rural Municipalities.

It was further considered that the "dollar for dollar" system of assistance had served a useful purpose in providing for board supervision and instruction in connection with the works carried out, and that the Rural Municipalities should now be prepared to continue the expenditure of their own monies in an efficient manner. After careful consideration, the Highway Board, at the end of the season, resolved that such assistance should cease and, in future, all monies placed at the disposal of the Board, should be expended directly by it, either by contract or by day labor. This new policy was carried out during the season of 1914 and resulted in an increase in the number of road crews employed and a large amount of work was satisfactorily carried out until the middle of August, when the financial depression, caused by the breaking out of the Great War, necessitated the closing down of practically all the road and bridge work.

Through the seasons of 1915 and 1916 this same policy was continued, although, on account of financial conditions due to the war, the work programme was much restricted.

In the Legislative session of 1916-17 the importance of the highway improvement work in the Province was given further consideration, with the result that the Highways Act came into force on April 1st, 1917. By this Act the Board of Highway Commissioners ceased to exist and the work has since been carried out by an established Department of Highways, as a regular department of public service, presided over by the Minister of Highways.

The work of the Department as now established, comprises the building and re-construction of all roads, designated as main roads throughout the Province, the erection of all steel, concrete and timber bridges; the building and operation of all ferries, the supervision of surveys and townsites, the drainage work of the Province, the reservoir and water supply construction necessary in districts requiring such attention, and the general supervision of all works, undertaken in these branches, on which Government money grants have been made.

In the earlier years of the work of the Highways Board it was determined that a main road system should be evolved, in the older settled districts, which could be gradually developed and extended as the settlement areas enlarged and the locations of market towns and elevator points were determined by future steam railroad lines being constructed, and the co-operation of the Rural Municipalities was sought in order to evolve this main road system in such a way as would meet, as far as possible, the wishes of the people themselves and thus avoid the criticism of being arbitrary in the selections of these main road locations or of neglecting to consult those who would be forced to use the roads, and it was even then felt that the Government money grants should be used in developing this system while the Rural Municipalities could look after the local feeder roads connecting into the accepted main market roads. It was also considered that the Municipalities should assume the responsibility and the cost of maintaining all such main roads on which Government grants had been given, and all contracts carried such a provision. But it was soon discovered that the changing municipal Councils, from year to year, meant changing ideas of what were to be regarded as main roads in the various municipalities, and the Highway Board was beseiged each year with deputations pressing for consideration of their various new locations and it became impossible to permit all of the changes thus suggested. It was also found that, to the great majority of the municipalities, the principle in the contracts relating to maintenance of roads already built, was not thoroughly understood, or to some extent, not fully recognized. These difficulties were contended with, by a continual pressure on the part of the Department to improve conditions, until the end of 1917, when it was decided to work out a definite approved main road scheme, covering the total settled area of the province, and to have all provincial money grants used in developing this main road system. In this work the Department sought co-operation with the local members of the Legislature and the municipal councils, and other sources from which information might be obtained. The plan has been practically advanced to completion, except in those sections where new railroad lines may be constructed and new towns located, or where it is impossible to determine what would be the future needs of these localities.

To stimulate the interest in the maintenance of roads already improved, a road drag competition was instituted in 1913 and all rural municipalities were encouraged to enter selected sections of roads in this competition; suitable prizes were given in each of the five districts into which the organized municipalities were grouped; and all the available data, on the beneficial results of the systematic use of the road-drag, sent out to all these municipalities. It was felt that the many miles of main and feeder roads, already constructed at heavy expense, were in danger of being destroyed and to require, if neglect continued, additional large expenditures for re-construction, simply for want of maintenance, and this competition was instituted to encourage the municipalities to undertake this maintenance work, as well as to demonstrate the effectiveness and cheapness of the method of carrying it out.

In the seven years during which this competition has been held, 145 rural municipalities have, at one time or another, entered a section of road in this competition; that 58 have been in for one year, 29 for two years, 19 for three years, 15 for four years, 12 for five years, 9 for six years, and 3 for the full seven years. Six municipalities have been in continuously for the past six years and five others continuously for the past five years. These figures indicate, to some extent, a lack of sustained interest in road maintenance work and it is apparent that some accentuated energy must be applied to keep the Provincial main roads in shape.

This descriptive historical sketch of the attempts made in the past towards a comprehensive workable system of improved roads throughout the province, has been written partially to show the great difficulties to be contended with in a province of the extent of this one, with sparsely settled areas, with over 200,000 miles of road allowances, and with constantly changing road requirements due to railroad extensions and the establishment of new market towns or elevator points, and partly to indicate the sustained interest taken by the Government of the province, in the effort to improve conditions for the benefit and comfort of those settling on the prairies and in the more broken wooded areas north.

The Department, as now organized, is controlled by a Deputy Minister, who is responsible to the Minister of Highways, with a working staff as follows: 1. A Chief Engineer and Superintendent of Highways, who has complete charge of the construction programme of the department and who controls the ten Divisional Superintendents, the Engineering staffs of the bridges and roads branches and the road-drag competition Inspectors. (2). A Director of Surveys and Town Planning Engineer who controls the District Surveyors and the Townsite Engineer, and has charge of all surveys for townsites, new railroad location plans, road diversions, and also has charge of all drainage works undertaken as local improvements under the Drainage Act of the Province. (3). A Chief Clerk and Superintendent of ferries who has charge of the purchasing and handling of materials and supplies, the control of the correspondence and office staff, the accounting work of the department and supervision over the Ferry Inspector, who controls all the ferries operating in the province. The working outline of the organization is shown on the blue print headed:—"The Organization of Department of Highways. Government of Saskatchewan". In the preparation of this plan it was felt that the best results should be attained by making each sub-head directly responsible to the Deputy Minister for the carrying out of the duties pertaining to the various matters under him and a proper adherence to the plan, as outlined, would increase the efficiency of the staff and prevent any misunderstanding as to which sub-head each employee is responsible.

The method of working is as follows: The Legislature votes an appropriation for the Highways Department which is divided into amounts for salaries, superintendence and supplies, capital bridges, roads, revenue bridges and repairs. The capital bridge expenditure is handled entirely by the engineering staff of the bridge branch after the locations have been determined, and which generally are determined on the recommendation of the local Divisional Superintendent confirmed by the Superintendent of Highways and the Deputy Minister. Plans and specifications are then prepared and all such works are handled by contract under inspection of a resident Inspector.

The amount set apart for road work and revenue bridge construction and repairs is divided by the Minister on the basis of the constituency unit, four factors being taken into consideration in making the division: First, and most important, the area of the constituency; second, the population of the constituency, as a well settled district would be reasonably entitled to more grant than one sparsely settled; third, the railway facilities enjoyed by the district as, where these are plentiful, fewer roads are required; and fourth, the topography, difficulties of opening up the district and the consequent cost of construction. Perfection is not claimed for this method of considering the constituency as the unit of allotment of funds, but on the whole it has worked out satisfactorily.

The Divisional Superintendent of the Department, after consulting with the interested local members of the Legislature and the Rural Municipalities concerned, then make their recommendations of what new bridges are required and what sections of our approved main roads should receive attention during the current year.

These recommendations are carefully checked and considered, together with all other information which may come into the department, and when approved, the bridges placed on a construction schedule to be built by special bridge crews working under the department's control; while the road work is handled either by contract with the municipality, under which they perform the work and are paid the money grant after the work has been inspected and passed by the Divisional Superintendent or carried out by a government road crew working under the personal direction of the Divisional Superintendent.

This system of operation keeps the control of the work and the payment of money grants entirely in the hands of the Highways Department, and we find that the municipal councils on the whole, are co-operating very well in carrying out the work, both as to location and method of construction.

Saskatchewan has now some 55,000 automobile owners out of a population of about 827,000 and the greater percentage of these cars are owned by farmers. The ownership of an automobile has also lent an impetus to the improvement of our roads as well as to the maintenance of main arteries of travel. Motor clubs are very general throughout the province and these have a system of reporting special defects on all roads to the Department of Highways through the secretary of their executive body and it is encouraging to note this as a sign of the interest being developed in the direction of permanent good roads.

As time went by, the importance of maintaining roads upon which money had been expended for construction, became more and more pronounced. To such an extent did this obtain that definite legislation was passed in an endeavour to cope with the problem. To this end a grant to each rural municipality was provided for. Each municipality in the spring designates the sections of roads they wish to maintain, these are checked up and, if found to be satisfactory, permission is given them to undertake this work. The sections undergoing improvement are inspected during the season and the municipality makes its return of the actual extent of the roads maintained and the expenditures incurred. If the Inspectors' reports are favorable, the amount is deemed to have been earned.

There are two difficulties which face the Department in connection with this; First, is the tendency, fortunately in only a few cases, to use the money in making good certain bad places on the roads, which improvement cannot properly be considered as maintenance work; and Second, the dividing of the amount of the grant into a number of parts corresponding to the number of council divisions in each municipality, irrespective of the number of miles of main roads in each division or of the special claims of certain well-travelled roads to be considered. But so long as this council view prevails just so long will the department be faced with this difficulty.

Whether by design of nature or the perversity of the Dominion Land Surveyors who gave the road allowances, it is nevertheless a fact that an undue proportion of sloughs, lakes, bad hills and awkward bridge locations occupy the road allowances and, while it leaves more land for agricultural purposes, this serves to increase our difficulties and the cost of our road improvement work. To overcome many of these difficulties it is necessary to divert from the road allowances. To deal with these matters in a satisfactory manner the department has provided a number of District Surveyors, working under the direction of the Director of Surveys who is responsible to the Deputy Minister and with him signs all plans of diversions, etc., before these become legal highways.

The proper location of these diversions demands a knowledge of road-building, as the question of drainage, gradients, side-hill work, suitable bridge and culvert locations and other features all enter into the determination of a well-selected diversion location. The usual method followed is for the rural municipality to request a diversion survey, after having made an agreement with the owner for the purchase of the land required, which agreement is filed with the Director of Surveys. The survey is then made and the amount of land taken determined and the construction of the improvement follows. In cases of improvements where the lands are not patented the diversions are made on the recommendation of our Divisional Superintendents, the surveys are made and registered, and the diversions are made a part of the road allowances, to be deducted from the acreage of the section affected, while in unorganized municipalities the same procedure is adopted with the exception that payment is made to the land owner directly through the department.

In some cases where the topographical features make the selection of a diversion unusually difficult, it is found much better to make a preliminary arrangement with the land owner for the land needed, to construct the needed improvement and to then make the survey and payment for the land taken. This avoids a clash between the surveys branch and our construction department over the securing of the best possible location and also avoids the need of a re-survey when the improvement cannot be confined to the limits of a survey already made.

In connection with the construction end of the work, it is not necessary to say much, as this subject has been dealt with in so many papers, magazines and text books that no new matter of interest can be given, so that only a few general observations, relative to the handling of road problems, as they are met, are required. First comes the question of the importance of the road to be improved which determines the proper width of the road to be graded, the character of any bridges and culverts required and the maximum permissible grades for the traffic demands of that district.

On main roads near the larger towns and cities, a width of 34 to 36 feet, between ditches is considered as necessary, for less important main roads, from 28 to 32 feet, and for feeder roads and those more remote from towns, from 20 to 26 feet according to the local conditions.

On important main roads it is aimed to provide permanent bridge structures of either steel or concrete and either concrete or galvanized steel culverts, while on roads of lesser importance, timber bridges on either pile or frame-bent abutments are constructed and the use of wooden box culverts is permitted where necessary.

The maximum permissible grade on a recognized main road is seven per cent. and an effort is made to keep it down to five per cent. wherever possible without incurring unwarranted expense in doing so. In many cases on less important roads the topographical features at times make it necessary to adopt grades as high as ten to twelve per cent., but these fortunately are the exception and only permitted where they cannot be avoided.

The matter of drainage is of greatest importance as, with earth roads particularly, the removal of water from the road and side-ditches is very essential if the highway is to be of use at all seasons of the year.

In order to provide for effective drainage the ditches should have a continuous fall to certain points where the water can be led away from the road allowances, and where such cannot be provided by natural drainage it must be provided artificially where possible to do so.

The whole of the road drainage question may be summed up as follows: In order to have a good road the water must be got out, off, and away; out of the road by under-drainage and by ditches of sufficient depth and gradual continuous grades to off-take ditches or natural depressions; off the road by means of a properly crowned cross-section of the road, and away in the ditches as already described.

Regarding the actual construction work the organization of the working crew and the equipment required depends on the nature of the work to be done and it is not possible to suggest a general outline which would fit all the varied conditions which might be met with. On ordinary grading work with close borrow pits for fills or on the ordinary steep side hill grades the use of slip or wheeled scrapers or fresnos are recommended. On fills of a sufficient length and height, as to warrant a bigger crew and equipment, the use of an elevating grader is recommended and it will be found to be economical even with the added cost of discing the long grade and crowning the surface with an ordinary road-grader. On lighter fills, side-hill work where the side slope is not very steep, and turnpiking the only economical method of grading is by the use of a road-grader, the size and weight of which should be determined by the nature of the soil to be handled and by the quantity of earth to be moved. Except where old stumps, roots or boulder stones are encountered it has been found that the modern type of road-grader, hauled by a farm tractor of suitable power, can do this work without any need of preliminary plowing of the earth and the cost is much lower than was considered possible even a few years ago. But the nature of the equipment used must depend on the extent and magnitude of the work in question and can be determined only by a study of the actual conditions governing that special work.

Every spring before the ground becomes too hard the road should be gone over with the road-grader to clean out the ditches, fill up the ruts and holes, plane off the undue elevations and shoulders on the road, improve the grade and crown of the road, and generally to put the road in good condition.

Earth roads show an undue tendency to rut and care should be taken in selecting material with which to fill these ruts, and a point to be borne in mind is that the same material should be used as that composing the surface of a road. It is true that a clay road is often improved by the use of a sand or fine gravel surface coat, and a soft sand road by the use of a clay coating, but these are the only exceptions.

On clay or gumbo roads any repairs should be made early in the season as the dampness together with the travel will aid in compacting the surface. If repairs are made late in the season when the soil is dry it pulverizes rather than packs, is very unsatisfactory, and will not result in a hard, waterproof, compact surface.

To maintain an earth road in good condition requires constant attention and it will usually be found that this attention is necessary from the very day the road has been completed. The work cannot all be done at one time, as it will be found necessary that a little be done and not to attempt to do too much at any one time. The best results generally are obtained by merely smoothing over the surface, covering up what small ruts there may be at the time, and to do the work when the surface of the road is moist or as wet as the soil will permit the work to be done, and this can best be done with a suitable road-drag. This road-drag, if properly handled, will keep the ditches clean and even, will keep the side-slopes and the ditches free from weeds. will preserve the uniformity and appearance of the side-slopes to the ditches and the crowned section of the road, will remove moderate ruts and uneveness of the surface and aid in securing a compact even surface which, after faithful continued treatment, will remain firm and compact even under moderately heavy traffic.

THE CHAIRMAN : This has been a very good paper, and one of special interest to many members of our profession whose duty it has been to examine roads in connection with the work this year. Mr. Dill is not a member of our Association and our thanks are due to him for the trouble which he has taken. I believe that papers from each of the other western provinces on the same subject would be splendid things to have on record. The matter is now open for discussion.

MR. ELHANNEY : I had intended to take up the discussion of this paper, but it is now rather late, and it is necessary for us to proceed with our programme. But I have much pleasure in moving that our secretary be instructed to send a letter of thanks to Mr. Dill for the paper which he has given.

The motion was seconded by Mr. Palmer and carried with applause.

THE CHAIRMAN: We are now to have a paper by Mr. R. Douglas, Secretary of the Geographic Board, on ''Place Names''.

PLACE-NAMES A NATIONAL ASSET.

The place names of a young country, such as Canada, are an advertisement which he who runs may read. They will be an asset almost as valuable as an additional natural resource if they give information about her natural resources, about the modes of thought and feeling of her people, about the pioneers who shaped her destiny, and if they reveal all that is best in her national life.

I propose to discuss the principles which underly such a system of nomenclature. To begin with, the privilege of naming features in any region of the earth is exercised primarily by the inhabitants of that region. Canadians, and Canadians only, have the right to name their own mountains and rivers and lakes. And as the residents of the particular locality in which a feature is situated will be the ones to use its name most, it must be acceptable to them if it is to prevail. When the region is unsettled the naming privilege falls to such others as you surveyors, who require a designation for the feature. In many cases an existing name is unsatisfactory. Here again surveyors may be called upon to supply an alternative. They may hesitate to change such names as Clear Lake, Buffalo Lake, and Trout Lake, because of inconvenience likely to be caused big-game hunters and tourists of a day, through the ignorance of native guides of the new name. Inconvenience of this nature can be overcome by the circulation of up-to-date maps. And after all, the interests of permanent settlers merit first consideration.

Sometimes a feature has more than one name. One of these may be Indian, another may be found only on some map. In such cases, local usage should govern, unless a name is objectionable. If local usage is not a factor, that name which is most appropriate and euphonious should be adopted, and, all things being equal, that which has priority of publication in some standard work or map.

Existing names are objectionable (a) when they are duplicated, especially within the same province (b) when they are difficult to pronounce (c) when they suggest unpleasant ideas and (d) in the case of Indian names, when they are of excessive length and cannot be curtailed.

It is not necessary that every un-named feature in a region should be named. The richly varied place-names of England reflect the thoughts of many generations. The names of the great natural features, the large rivers in particular, given by the pioneers remain to-day. The lesser feature names that survive are those given by later races as the social order developed. From this we conclude that the first explorer of a region should not name more than the larger un-named lakes and rivers, and that if features are left to be gradually named as the region is settled, the result will be more satisfactory than if names are given at one time and by one person.

It is sometimes more important that an objectionable name should be removed early than that a still un-named feature should receive a name. For instance, an explorer finds the name, Long Lake, and defers changing it. The Post Office Department, or one of the railway companies, or a trading company sees the name on the map and adopts it for a post office or railway station or trading post; any of them the possible nucleus of a city. Instead of one feature with an objectionable name, there are now two, and making a change is doubly difficult. The explorer should not defer changing a name to a town before that happens. For instance, Stewart Lake Tp. 17-5-P, Manitoba, has dried up, but Stewart Lake post office remains.

Unsuitable names may be replaced by, or new names selected from two kinds of names (a) impersonal descriptive ones and (b) personal ones. Both are found in English and, for that matter, in Canadian native names. The first may be (1) topographical and describe the natural features of the region. Thames (probably) means either the ''quiet'' or ''wide'' river, the Humber is the ''cumber'' or ''confluence'' river, corresponding to our Mattawa and the Ouse or ''Wet Mud'' is something like our Winnipeg river. They may be (2) indicative of the natural products of the place, as for example, Hay River, Cobalt. They may (3) indicate animals which resort to the place as Whitefish Lake, Red Deer River. They may (4) indicate position or direction from a place previously known as Abitibi or half-way lake, or (5) they may be historical, preserving the memory of some important event as Battle River, so called from the number of battles on its banks or Peace River, so called from a point on it where the Indians were persuaded by the traders to terminate their wars and feuds. The more common names of these classes have been used up, but many euphonious scientific and technical words expressing finer shades of meaning are available.

There is room for this sort of names that go into detail or particularize. For instance, instead of naming a place Hay Lake, or Bear Lake, or Bird Lake, state the particular kind of Hay, Bear or Bird. A great number of compound words, embodying commoner names have also been used. Besides Beaver lakes and creeks and hills, we have Beaverbank lake, Beaverdam creek, Beaverfoot river, The Beaverhead, Beaverhill lake, Beaverhouse creek, Beaverbrook town and Beaverton village. All simple names, however, have not been so hard worked as Beaver, and good names of this sort must yet be quite plentiful.

Impersonal descriptive names may be used to replace unsuitably named large or small features.

In the case of personal names, the importance of the person or event to be commemorated should bear some proportion to the size and importance of the feature. As a rule the names of national heroes or events should not be applied to small features, nor those of local heroes and events to large ones.

While descriptive names are often desirable for variety, yet the selection of a distinctive one, may be more difficult than of a personal name. The Indian named places after noted warriors, but it seems to have been left for the Englishman especially to commemorate himself, or his family by a name. A great many English village and town names interpreted, are merely this Prince's or that thane's town, being names after the founder or former owner. With this may be contrasted the French-Canadian custom, seen in Quebec, of naming places after their patron saints.

The best personal names are historical ones, with a local or national significance, or both, say those of early traders, travellers or explorers, or of some great event or personage of the time in Canadian history. A good example of a historical name is Cardinal river, the north branch of Brazeau river which commemorates Jacques Cardinal, a noted figure in the fur trade whose grave is on the bank in Sect. 13. Tp. 45-21-5. Cardinal is referred to by travellers through Athabaska pass, 1820-30 as an old man living near Henry house, in charge of the horses used by the fur trade brigades. The suggestion for this name came from Mr. D. B. Dowling, geologist, who saw the grave and made a note of its position.

It is sometimes said the names of living people should not be applied. There is as little reason for witholding the name of a living person from a natural feature, as for witholding praise from him till he is dead, and we may be dead first.

The "ignominy of a shifting white nomenclature" as W. B. Cabot calls it must be avoided. Sometimes, for example, there is a choice of two local names, one descriptive, and one personal. The personal one may be more commonly in use at the moment, but it is not, therefore, to be preferred. As Cabot says of the Labrador Indian river name "assiwaban", which he rescued from obscurity. The river is best known as "Frank's brook," from the name of a one time resident near its mouth. These personal names given to bays and rivers are more or less subject to change, accordingly as the settlers change and succeed one another. One year the river may be Smith's, another year Jones' and in due time, perhaps, Robinson's.

The system of naming branches of rivers South branch, North branch, East fork, etc., is undesirable; individual names are preferable. The names of main streams should be carried to the headwaters.

When names have been changed or corrupted, if not too firmly established by local usage or otherwise, the original forms should be restored.

A new name of which the meaning is not known should not be given and no new name should be given without setting down a note of its meaning.

The use of manufactured Indian names is not recommended. Why revert to a dead language when there are two living ones, English and French, from which names may be selected ?

New names should not be nicknames or shortened names of persons, or corrupted names, such as Sipra lake for French Cypres.

Names whose proper pronunciation may be misunderstood from their spelling or which may readily be confused with a more common word are objectionable.

The same name may be applied to more than one related feature, except that a lake and a stream in the same district should not bear the same name unless the lake forms the source of the stream, or the stream does not rise in a lake, and the lake for which the name is proposed is situated on the main stream.

In districts where there are settlers of foreign origin, simple and euphonious names in the old language of the settlers are not objectionable, but this hardly warrants, as happened recently, the giving of a Spanish name, Rio Grande, to a post office in the Grande Prairie region, from the mere resemblance of the adjective and the fact that there is a river (Red-Willow) half a mile distant.

French place names recolling the presence of the early French voyagers and traders survive in many parts of the west, and should be retained as a general rule.

Information about names is very easily lost if not noted. For instance, Weyburn city, Sask., was named by the Late Sir Wm. White of the Canadian Pacific Ry. in 1891 or 1892, but the meaning of the name is unknown. And some published statements about the origin of names are entirely erroneous. Surveyors have done and can do good work in gathering or checking information, which often involves much important history. West and southwest of Moosejaw, for instance, are two large alkaline lakes which have appeared on maps since 1865 as lakes Chaplin and Johnston. It was definitely ascertained only recently that the spelling Johnston was a mistake, and whom the lakes were named after. The hint of the origin came from Mr. J. N. Wallace, D.L.S., Calgary. Subsequent enquiries brought a letter from Viscount Chaplin stating the lakes were named in 1861 by Dr. (afterward Sir) John Rae, who in that year accompanied the writer and Sir Frederick John William Johnstone Bart (1841-1913) then Oxford graduates on a hunting expedition to the prairies from England. Mt. Rundle, Alberta, commemorates an early Methodist missionary to the Northwest. To a geologist one is indebted for the following interesting information about Rundle, which he copied into his note-book from an inscription in some museum in Banff: Rev. Robert Terrill, Rundle, reached Edmonton 18th September, 1840, Rocky Mtn. House, 22nd Feb., 1841, camped at foot of Cascade mountain four or five weeks, August, 1841, returned to England 1848. The names of smaller features are surrounded with equally interesting information. To Mr. G. H. Blanchet, D.L.S., I think is due the suggestion that the Parlentpas rapids, Peace River, are so called, not because of their silence, (they are not silent) but because they are so dangerous that one must shoot them in silence with every sense alert.

THE CHAIRMAN: This paper is a very timely one. It is too bad we did not have it earlier, before we did so much of our work along the base lines in the north when hundreds of names had to be furnished and we had not much idea how to go about it.

MR. BLANCHET : Mr. Douglas speaks of Indian names. In portions of the country inhabited by the Indians and which are not likely to be developed it seems reasonable that the Indian names, if suitable, be retained.

MR. DOUGLAS : Yes, but they should not be manufactured.

MR. SEIBERT : This paper has been a very interesting one to me. When I first started out on base line work I had occasion to name quite a few natural features, and I must admit that I was at a loss to know just what names would be most suitable. We had occasion to give a name to a creek running through a series of muskegs; then there was a sudden drop and another series of muskegs, and so on through four or five muskegs, and drops. It was rather objectionable from the transportation viewpoint, and the best name we could think of at the time was ''Drop-off Creek''. I was criticized very severely on that point, and I am not sure whether the name has stood or not. Last year I got a copy of a letter sent through Mr. Wallace stating that a lake in northern Alberta had been named Seibert Lake. I do not object to the honour of having a lake named after me, but I did write to Mr. Wallace expressing some criticism upon the attaching of a German name to a Canadian lake. I have not received any reply; I suppose Mr .Wallace is still engaged in drafting one.

MR. HENDERSON : In a certain sense I feel responsible for this paper. We have to do with the surveyors' returns to the Topographical Surveys Branch as regards names. Prior to the last two or three years no one was specially looking after this matter of names; but now when a surveyor puts in returns on which there is an objectionable or duplicate name it becomes our duty to write to him and get him to suggest something else; or, if he has left the feature unnamed, to have him suggest a name and to give its origin. This sometimes involves quite a lot of correspondence,, and it occurred to me that if we could get the Secretary of the Geographic Board to come before the surveyors and give a paper outlining the principles that should guide surveyors in naming these new features, a good deal of trouble might be avoided. Mr. Douglas is to be congratulated on the way he has handled the subject and the members of the Association will do well to keep this paper before them when they get the printed report and to make occasional reference to it—especially those who have to do with the naming of new features.

MR. PIERCE : This paper has indeed been an interesting one and is more refreshing than some that we ordinarily get at meetings like this; that is, it is altogether out of the line of the matter which is usually covered in papers given at our meetings. We must all realize that in the past we have missed a great many opportunities of applying suitable names to lakes and other features—mostly due to our lack of knowledge in the matter, which has been taken care of in Mr. Douglas' paper. I remember hearing not very long ago about the origin of one name.

MR. HENDERSON : We have with us to-day Mr. Dowling, who is a member of the Geographic Board. Perhaps the Chairman will call on him to make some remarks on this subject.

THE CHAIRMAN : We are always glad to hear from Mr. Dowling.

MR. DOWLING : All I have to say is this: the work of the Board is cut up into little pieces, you know—we get one name at a time, and so on. But so far as the Board can, they are trying to follow some definite plan, as Mr. Douglas has outlined to us to-day, of making the naming of a place somewhat a part of its history. Of course, we cannot always do that. It is true that in some cases this has already be done. You may be surprised to know that the names of all the islands in the St. Lawrence river from Montreal to the head of the lakes are the names of the gunboats and small vessels that were taken by the British in the war of 1812. So the names of the regiments, officers and so on, of Montcalm's army are preserved in the names of townships in new Quebec, down near the Abitibi; and the names of generals, vessels, monarchs, battles and so on, connected with the recent great war, are being placed in groups, so far as possible, in the Rockies, on the Alberta British Columbia boundary line. We have interspersed with these a few of the old original names of some of the principal mountains; but you can see that underlying it all there is something of a definite scheme.

The meeting adjourned until 8 p.m.

The meeting in the evening was held in the Collegiate Hall and was open to the public.

THE CHAIRMAN : Ladies and gentlemen, the first item on our programme this evening is a series of lantern slides illustrative of survey life. Most of you are aware of the work which is done by Dominion land surveyors; it is carried on chiefly in the Northwest, and many difficulties have to be overcome. These pictures are not meant to be exemplifications of the art of photography; they are simply to show you some of the work that we are doing and some of the difficulties that we encounter.

(The slides were then shown and explained by Mr. P. A. Shaver).

THE CHAIRMAN : We have with us to-night General Sir Arthur Currie. It would be superfluous for me to make any introductory remarks with regard to the distinguished gentleman who was the leader of our gallant forces overseas; his achievements and the results that were obtained under his leadership are well known to all of us. It has been said by some of our friends to the south that the war was won by "Yanks, banks and tanks". I think Sir Arthur Currie can tell us that the winning of the war was due in large measure to the efforts of the engineers. This war has been more a war of engineering than any war of the past. I now have much pleasure in calling upon Sir Arthur Currie to address us.

Sir Arthur Currie's appearance was the occasion of hearty applause. He said:

Mr. Chairman, Ladies and Gentlemen,—

I regard it as a high honour to be privileged to address this meeting held under the auspices of the Dominion Land Surveyors' Society. It is suggested that I speak to you on the work of the Canadian Engineers in the Great War, or "Engineering problems of the Great War." For your sake I could have wished that someone more qualified than myself had been assigned this duty—someone with sufficient technical knowledge to present the subject to you more interestingly and more intelligently than my ignorance will permit. Yet, I welcome the opportunity of saying something of the work of that splendid corps—the Engineers—who on account of their own modesty and on account of the perfectly natural tendency to remember chiefly the role of the infantry, the general public often fail to appreciate.

Let me begin by defining the mission of the Engineers in France: It was to apply engineering science to the emergencies of modern warfare in order to protect and assist the troops, to ameloriate the conditions under which they are serving, and to facilitate locomotion and communications.

Perhaps I should pause here to point out one essential difference between the engineer of everyday life and the engineer of the army. In civil life, he is purely a technical adviser. In the army, he is not only a technical adviser but he is the contractor as well. In civil life, he advises; he prepares the plans; he supervises the construction of the work. In the army, in addition to giving advice, preparing plans and supervising construction, he performed the actual work of construction in many instances for the first few years of the war, and in all instances, in the Canadian Corps, during the last months of the war.

Until May 24th, 1918, the organization of Engineer units within the Canadian Corps was exactly the same as that of similar units in the Imperial service. Upon the conclusion of the offensive operations which culminated in the capture of Passchendaele in November, 1917, the Chief Engineer of our Corps again urged the reorganization of the units and the personnel required for engineer services, upon the ground that the Imperial establishments and organizations were entirely unsuitable for coping with the situation and the conditions developed during the war. It was a matter which we had often discussed, and I was in full accord with his views. A proposal for the reorganization was put forward, receiving the endorsement of G.H.Q., and the Overseas Minister, and was brought into effect on the date above mentioned, May 24th, 1918. The reasons which led to the change being carried into effect were briefly as follows:—

When the war began each division had available for carrying out engineer services three field companies; each, administratively a complete unit, of a strength of 215, making 645 engineers in the Division. These field companies were composed of highly trained men, almost wholly intended for supervision, and able to accomplish little work by themselves. The need for an increase in the personnel of the Engineers was soon realized; and there was added to each Division a pioneer battalion which was placed under the C.R.E. of the Division for work only, but not for administration. These pioneer battalions were very useful units, and more so if officered by Engineer officers; which was not always the case, though I do not wish to intimate that all officers who were not Engineer officers were unsatisfactory.

Under the old system they were frittered away on all sorts of jobs throughout the Division, and were subject to all the evils which arise from dual control. It was the practice in the earlier days, and a necessary one, to detail daily working parties from the infantry to execute the work under the supervision of engineers. This proved to be a very unsatisfactory and costly method. The Engineers laid out the work, were responsible for its supervision, for getting on the ground all the necessary tools, material and supervision and labour required for the execution of any job, had this result: only about 25% of the work required was executed although the men themselves had probably expended the energy required for a full day's work; the fighting efficiency of the infantry was being impaired; their training was being interfered with. We were forced to ask a man to fight a battle to-day and build a road to-morrow. That was unfair. We had little enough time to train an infantry soldier to be an expert rifleman, bomber, Lewis gunner, etc., and yet we had to ask him to become a road builder, water-works constructor, and all the other things which an engineer must be.

We felt that it would be much better if we could leave it to the infantryman to do the actual fighting, the work for which he was trained, and create an engineer organization sufficiently large and self contained to carry out all engineer services. For a while we tried a compromise, viz., the attachment of a permanent working party to field companies; to which system there were sound objections raised by infantry commanders. It increased the discrepancy between War Establishments and trench strength and interfered with the organization and development of the platoon which is the fighting unit of the infantry. It dislocated infantry training and prevented non-commissioned officers and men in these permanent working parties from gaining promotion in their own units. They quickly forgot their infantry training and became engineers.

The introduction of new weapons and new methods of attack and defence was rapid and progressive and constantly rendered more difficult the engineer problems to be solved. The depth of the battle zone had to be increased enormously, owing to the increase of range of trench mortars and heavy artillery. In the beginning of the war, most of the guns were low trajectory weapons, but the high angle gun forced us to go underground to gain protection. The bomb-dropping devices in connection with aeroplanes made of the latter a long range weapon with direct observation; and in consequence steps had to be taken to provide protection for troops even in rear areas, where, normally, no such work was necessary at the beginning of the war. Furthermore, the enormous increase in the number of guns created the necessity of providing means by which the very large tonnage of ammunition could be delivered at these guns. This meant railroads, tramways, sidings and much greater wear and tear on roads, all of which are under the care of the Engineers.

The advent of the tank with the 37-ton axle load required that during an advance, engineer works of the most substantial nature should be executed with the greatest rapidity; and these results it was considered could only be accomplished if the personnel permanently allotted for the execution of engineer services were greatly increased, and if the technical supervision, skilled labour, unskilled labour, material and transport were merged into one organization under one control.

We had in France, in addition to these engineer companies and pioneer battalions, three tunnelling companies, concerning whose work I shall make a reference later on. Within a Division the personnel of the three field companies and pioneer battalions was recognized by utilizing each field company as a nucleus, absorbing the pioneer battalion; and by the addition of a proportion of a tunnelling company and other personnel there were created three engineer battalions, and a bridging transport section, the whole constituting an "Engineer Brigade". In forming the engineer battalions, care was taken to provide for the dilution of the highly skilled sapper personnel by including in due proportions men semi-skilled and unskilled Class "A" labour, who had completed their infantry training.

The Transport, both horse and mechanical, was increased so as to provide the amount it had been found, after several years experience, was necessary to ensure the delivery of engineer stores during active operations; and we find that the three engineer companies, which at the beginning of the war formed part of the Division, developed into three engineer battalions to a Division, at the close of the war.

This reorganization was carried out in the field under a great handicap but it was completed the last week in July, 1918.

During the first week in August, in preparation for the battle of Amiens, the new organization was subjected to its first trial, a very severe one, which more than justified the change.

During the final hundred days, to ensure the rapid advance of the Canadian Corps, the Canadian Engineers provided from themselves all necessary facilities in the way of cable and signal services, communication trenches, infantry tracks, mule tracks, plank roads, metal roads, pushed tram-lines. mechanically propelled tramways, bridges, water supply, demolitions, investigation parties, camouflage, etc., without calling upon any other troops for a working party. The fighting efficiency of the other arms was therefore not impaired in any way, and they were enabled to conserve their entire energy and devote it to the task of overcoming and wearing down the enemy opposition. The value of this was seen in the rapid and unprecedented advances made and sustained by the Corps. I am not saying too much when I say that to the reorganization of our engineer services, was due, in large measure, the success of the Canadian Corps during the final hundred days.

With the Canadian Corps, the corps was the fighting unit; this was due to the fact that the Canadian Corps was composed of four permanent Divisions, whereas, in other Corps, the Divisions were constantly changing. The work of the Corps naturally fell into four main departments: General Staff (which dealt with training, intelligence, operations, defence schemes, etc.) Artillery; "A" and "Q", and Engineers. The work of each department was closely involved with that of every other department; and it is due to the co-ordination and co-operation of all these departments that good results were obtained.

The Chief Engineer was the Technical adviser of the Corps Commander on all engineer services; and in addition, he administered the Canadian Engineer personnel in France. He was given a sufficient staff, and under him four Field Engineers, one each for defences, water supply, tramways, and roads.

The engineer services within the Corps were divided, roughly, into Divisional Areas and Corps Area. A line of demarcation was settled upon, in front of which Divisions were responsible for carrying out their work. In the rear of this line was the Corps Area, in which all necessary work was carried out by the Corps Engineer troops, working directly under the Chief Engineer. These corps troops often varied from 20,000 to 50,000 men, and were served by five engineer companies. With each Division we had an Engineer Brigade, consisting of three battalions and one bridging transport section. Each battalion, roughly 1,000 strong, was divided into headquarters and four companies, three of which were organized for general engineering work and the fourth for tunnelling and mining work. The bridging transport section carried sufficient pontoon and other bridging equipment to enable 225 feet of medium bridging to be constructed. A medium bridge is one which will carry field artillery, cavalry in sections or infantry in fours.

When the Corps undertook an operation involving more than one Division, the engineer units were pooled and came under the executive control of the Chief Engineer for the operation.

Under the Chief Engineer were placed defences, roads, tramways, water-supply, offensive and defensive mining, tunnelling, bridging, demolitions, the supply and manufacture of the necessary engineer stores, and the construction of accommodation for troops and horses. Let us examine these in greater detail.

As to defences: The general policy governing them, their nature and siting, was laid down by the General Staff. They were constructed under the supervision of the Engineers—in Division—at Areas, under the O. C. the Engineer Brigade, and in the Corps Area, under the Chief Engineer.

Defence includes wiring. In the early days, the wire was strung along wooden posts driven into the ground by a mallet. Often one could hear the enemy pounding their sticks in. The question immediately arose as to whether it was advisable to shoot up their wiring party with machine guns, or to get out and get busy ourselves. We usually adopted the latter plan until we got out a fair amount of wire in front of our immediate front line. The wooden posts were soon replaced by wire screw stakes, which had the advantage of it being possible to put them in place without the enemy hearing what was going on. In addition to the wire sticks, we made up "knife-rests", so called because the frame work resembled a knife-rest. They were made up in the rear, brought up at night, and thrown over the parapet. In the beginning, the wiring was done by the engineers, and special wiring parties who were known as the "Suicide Club"; yet, strange to say, although these men of ten worked in "No Man's Land", their casualties were few. In latter years, every man was trained in the art of wiring,—trained in squads of ten. We knew exactly how much wiring a squad of ten could put in so many hours, working either by day or by night. I have seen remarkable demonstrations of rapid wiring. I think a squad of 10 men can put up 50 yards of double-apron wire in some eight or nine minutes, and battalions did not take long to wire themselves securely in.

In the Lens area, where the Corps was for many months, we erected hundreds and hundreds of miles of wiring. In front of our second line, there were seven belts of this double apron wire; and in front of our main line, another seven belts. The wire was not put up in a haphazard fashion but was erected in relation to the machine guns which covered it. If you saw a long belt of wire stretched out in one direction, you knew that there were machine guns sited so as to sweep that wire. There is nothing which holds up troops as quickly as barbed wire; and during the war many unnecessary casualties were caused by troops being ordered to attack when the wire had not been sufficiently cut. This cutting of wire was a difficult operation until the advent of the .106 fuse. One of the great advantages of tanks was that they were able to cross uncut wire, crushing it down so that the infantry could follow on at once. They were fitted with grappling irons which pulled the wire completely aside.

After barbed wire comes trenches. The first thing a soldier cares about after reaching a position is digging himself in, and for this purpose he is provided with what is known as an "entrenching tool"; yet it was often the custom to send in with troops about to make an attack, a certain proportion of spades and picks. If not sent in with the troops, they were got up as soon after dark as possible. In many parts of Flanders, it was impossible to dig trenches, the water lying so close to the surface. Trenches were constructed in those areas by filling sandbags and piling them up one on top of the other —a very unsatisfactory method. They were soon pounded to pieces by shell fire, and the bags rotted after being exposed to wet. The piling of sandbags is an art; and many troops suffered much discomfort from the imperfect way in which the work was often done. All who have served in France know what is meant by sandbags "slithering in". When we were in an area where trenches could be made, we dug down, at first making our trenches deep and narrow; but the winter of 1916-1917 cured us of that folly. We then made them much wider and took care that they had a proper berm. Although the narrow deep trench gave greater protection from shell fire, the wide trench permitted much more rapid movements. In connection with the building of trenches, a proper system of drainage has to be put in, and bath-mats have to be laid. The trenches were revetted—chicken wire, corrugated iron and hurdles being used. The latter being the most satisfactory. A trench revetted with corrugated iron, after a severe shelling, requires a great deal of work to get it in any sort of decent shape again. Leading from these trenches were the dugouts for the garrison. The Germans taught us all we knew about the construction of dugouts. Until the battle of the Somme was fought, ours were principally of the "OldBill" type, viz., a square excavation in the side of the trench covered with corrugated iron, and a layer of sandbags. When we over-ran the German trenches at the Somme, we found dugouts quite 30 or 40 feet below the surface and often leading down to a second tier of dugouts. There were often lighted by electricity and could be made very comfortable. You can readily understand the technical training the engineers were required to have in order to construct these dugouts. We aimed at providing sufficient protection for the troops in the trenches and dugouts, and our outposts. Headquarters signal stations, and report centres, were similarly protected. These dugouts often became, in a battle, death-traps for their inhabitants. A severe shelling previous to an attack forced the garrison into the dugouts, and we aimed at our infantry arriving in the hostile trench before the defenders could emerge from them. If the interned garrison did not immediately surrender, bombs were thrown down and mobile charges exploded, blocking up the entrance. In an attack, special parties were told off to deal with any of the enemy who might be hiding in the dugouts. These parties were called "mopping up parties."

With the dugouts, go the subways (underground passages from support lines to the front lines) which when we had time we constructed so as to avoid having to come out of the trenches. Before the battle of Vimy we had been able to construct a great many of these subways. One division, I remember, had a light railway installed and was thus enabled to get all its bombs, trench mortars and other ammunition supplies, etc., up to the front line without exposing the carrying party to the dangers they would be subjected to if forced to go above ground. In our defence of Hill 70, we were making the subway the back-bone of the defence. This subway, besides providing safe passage to the front, also gave safe living quarters to the garrison, and from it stairways lead to machine-gun emplacements, carefully camouflaged along its entire length. It was compartmented in order that access to one part of the tunnel would not mean that the whole thing was permanently lost.

Following wiring, trenches, dug-outs, etc., come machine-gun emplacements. During the war there was a great advance in the tactical employment of the machine-gun. At first, the emplacements were simply open emplacements with no other protection than what the ordinary trench afforded; then we sought to give them head-cover protection from shrapnel. This was simply a rude structure covered by sand bags. With the increase in the employment of high angle guns came the necessity for further protection; and by the use of beams, heavy timbers, sand bags, etc., we were able to provide it to a certain extent. Naturally, a demand for cement arose in the making of these emplacements. But the British Army did not make many cement machine-gun emplacements, owing to the lack of cement. Much of the product of our factories went to Holland, where it eventually found its way into the German front areas. The enemy employed this type of structure to a large degree; along the Hindenburg line from Neuville Vitasse you could count cement machine-gun emplacements every hundred yards. They also used it in the construction of pill boxes, which formed the frame work of their defence system in the Flanders area, where it was not possible to make a dug-out. These pill boxes were a very hard nut for us to crack in the third battle of Ypres, 1917, We favoured the Champagne type of emplacement. This consisted of a tunnel, often running one hundred yards or so out from a living trench, and coming up to the ground in a six foot opening carefully camouflaged. The crew would live in the tunnel with their guns and ammunition supply; and when the hostile attack developed, they would take up their position in the opening, a place entirely unsuspected by the enemy. Some hundreds of these machine-gun emplacements formed a large part of our defences in the Lens area. In the later part of the war, when the fighting became more open, the main defence consisted of a loose pattern of machine-gun strong points. These were simply circular pits, dug into the ground, camouflaged whenever possible, and of a sufficient size to hold the crew and ammunition.

I have made reference to a mining and tunnelling detachment with the Engineers. Defensive mining was carried out to protect our lines from attack underground by the enemy, and to ascertain his whereabouts underground, and his intentions. This form of warfare began in 1915; was very popular in 1916; and ceased in 1917, when we got the upper hand along practically the entire front. The tunnellers would dig down into the ground and burrow along until they heard the hostile miner working. Listening sets were installed and incessant watch was kept. When we concluded the enemy was in a position to blow his mine, we would endeavour to anticipate him. In such close proximity have the miners worked that our listeners could frequently hear the Boches talking; and on several occasions we quietly broke into their tunnels, killed their miners, carried away anything that was valuable, and destroyed the workings. Offensive mining is carried out to attack the enemy's workings; to destroy enemy strong points; to defilade the fire from machine gun nests which cannot be reached; to break a hole through the enemy's first defensive system; to blow communication trenches intended to connect our system with his; and to provide for our own troops a passage covered from view.

An attack of ours in which mining played a great part was at the battle of Messines, on June 7th, 1917, when we blew up, on the Messines and Wystchaete front, some twenty miles, practically destroying the enemy front line system and so shocking the defenders that rapid progress on our part was possible. So completely did we demonstrate our superiority in mining in that battle, that thereafter the enemy practically ceased this form of warfare. The decision was greatly welcomed by ourselves, because we believed not sufficient results were obtained from the enormous amount of work entailed. It was a form of warfare forced upon us by the enemy, and one which we most gladly gave up. The Canadian Corps had a good deal of experience with mining activity on the Vimy front, Hill 60, Hooge and Mont St. Eloi front.

Leaving the question of engineer services in the active work of defence, we come to accomodation; and to appreciate this we must remember that the Canadian Corps was practically a moving city, with a population varying from 105,000 to 160,000 men, and from 25,000 to 60,000 horses, the whole or part of which often moved on short notice. The provision of the necessary facilities to provide for the existence of this moving city constituted an important problem. It involved the provision and erection of the necessary hutting, for quarters for officers and men, and in winter for shelter for horses; the necessary sanitary arrangements, such as latrines, baths, laundries, etc., the provision of water for man and beast; and the one hundred and one things which are required for the maintenance of such a population in the field. Arrangements have also to be made for the reception of the necessary supplies, rations and forage, ammunition, etc. This involves arrangements for railway sidings, in and out roads to them; development and maintenance of well defined traffic routes to enable the heavy traffic to move without interruption, transport of supplies and ammunition to dumps and refilling points from which they are distributed; and at these dumps and refilling points, facilities have to be provided for means of access, suitable covering for winter, and protection from damage by bombs and shell-fire. Arrangements required by the medical department for the handling of sick and wounded involved the provision of roads or tramways for their evacuation; also the construction of regimental aid posts, advance dressing stations, main dressing stations, and casualty clearing stations.

Reference has been made to water supply. This involves the provision of water supply necessary for drinking, cooking and washing for the men, and water for the horses; while, in addition, arrangements have also to be made in case of having to move suddenly into a new area a large number of men and horses; an area in which, probably, little is known of the facilities for water supply. In passing, I may mention that an important feature of the question of water supply for horses is that they must all be watered three times a day; and the strain on the available supply comes on at approximately the same hour. Furthermore, as it is very uncertain what engines and pumps are available, methods have frequently to be improvised.

I remember that at Ecoivres we developed a very large water supply, installing our own camp, and laying hundreds of miles of pipe to distribute the water. These pipes were laid on top of the ground to begin with, but as labour became available they were buried. In some of our areas we had water laid to the front line trenches. At Fosse 6, near Vimy, our Engineers developed a water supply capable of providing 3,000 gallons an hour; and at Fosse 3, near Hill 65, we were developing a water supply of 4,000 gallons an hour. One interesting thing which occurs to my mind in connection with the water supply was our system of baths. We aimed to give every man a bath once in eight days.

The construction and maintenance of roads was also another very important feature. There were many good roads in the country where we served; but during the war the traffic on them was much greater than what had been contemplated when the roads were built, with the result that in bad weather many of the roads broke up. They required the most constant care and supervision. Many of them have been altogether re-built. In the forward areas, the difficulties were enormously increased; many of the roads were under enemy observation, and so no work could be done in the day time. As there was no traffic on them in day time, it followed that you had to repair them when the traffic was most busy. It was often found that additional roads had to be made. To do this quickly we advocated the construction of corduroy roads, or plank roads—a suggestion which was not at all enthusiastically received. In fact it was pooh-poohed until we had demonstrated the worth of a plank road, after which many such roads appeared. I remember our application for planks to build such a road was refused.* We then asked whether, if we could not get planks, we could be furnished with a saw mill. This was given to us, and in Bois de Alleux we cut down the trees and made our own planks—an example of resource and initiative for which our Canadians became famous. Many infantry tracks and mule tracks had to be constructed and well marked. The proper way to mark a road was something we learned from the Boche; and many of my audience will well remember such signs as ''O.U.'' ''Denain'', etc.

Closely associated with roads are bridges. Apparently, the only bridge which was contemplated the Engineers would be called upon to put in position, was one made of pontoons; and most faithfully the sappers kept their pontoons for many months, during which time it looked as though no need for them would ever arise. The only use to which I saw the pontoons put in the early days of the war was to furnish a grandstand at a sports meeting, or a platform for a boxing-bout. During the last hundred days, however. the pontoons well repaid the care they had been given, and the practice of putting them into position. In the last hundred days the bridging problems confronting the Engineers were very numerous and varying; while the difficulties were much increased by the thorough demolition of the original structures.

When the Germans were driven back they succeeded, in most instances, in destroying their bridges; not only were the girder sections cut by explosives and dropped into the river or canal, but the abutments were completely destroyed, and large craters blown in the approach roads. These craters had all to be filled, or bridged, before the heavy bridging material could be rushed forward. The reconstruction of these bridges was necessary to the development of our communications, and they were a tempting target for the enemy. As a general rule, they had to be erected on the original site as, otherwise, a traffic diversion and road had to be made, and this involved loss of time. The bridging operations may be divided into three phases, viz:—

First crossings for infantry.
Second crossings for first line transport.
i.e., field guns, horse transport, etc.
Third, heavy bridges to take tanks, 6 in. guns, lorries, etc.

Infantry Crossings.

These consisted of improved crossings, or cork pier foot bridges, over the damaged structure. Sufficient slaps of cork to give the requisite buoyancy were baled together with wire netting and nailed across the stringers, and the bridge so formed took infantry across in single file. The German foot bridge was simbilar in many respects, with the exception that instead of work piers he used hollow wrought iron cylinders. These were more easily handled, but very easily punctured, and the bridge put out of commission.

Crossing for 1st line transport.

The pontoons and trestle equipment of the Army proved itself invaluable for crossing the canal systems; and a bridge of 90 feet span could be erected in 1 to 1½ hours under adverse conditions. As an example of what can be done in speedy pontoon bridge constructions by trained sappers, the following may prove interesting. The 12th Field Company, Canadian Engineers, erected 10 bays and one shore bay, total length 155 feet, of medium pontoon bridge, in 9 minutes and 48 seconds. This was in England, and all the pontoons and equipment were unloaded and sorted out on the beach, but none were in the water prior to construction. Over the rivers various expeditions were used; but, in general, trestle bridges were constructed with any material available.

Heavy Bridges.

The construction of heavy bridges over the canals presented many problems; the latest type of tank had a live load of 37 tons, and the new 6 in. gun an axle load of 17 tons. The canals were approximately 90 feet wide, and the clear span necessary about 108 feet. Clear span bridges were often required, as it was impossible to remove the damaged structure, and its presence in the bottom of the canal prevented the use of trestles and cribbing, at least for speedy construction. To make a traffic diversion off the main road took time, owing to the nature of road required to carry heavy traffic. The British Army had adopted a new bridge called the "Inglis Portable Military Bridge, Rectangular Type," and this proved invaluable. It is composed of a number of identical bays 12 feet long, 12 feet high, and 12 feet wide, and was designed to carry a dead load of 84 tons distributed over a clear span of 84 feet. The bridge is of the Warren Girder type, lap welded tubes, thickened at the ends and pin connected in steel junction boxes. The transoms and transverse stiffeners are I beams, the web being cut out in places by oxy acetylene plant, to reduce the weight for handling to a minimum. Each part of the bridge can be manhandled, the weight of one 12 foot bay in skeleton form (that is ready for launching) being 1.735 tons, and one bay of the finished structure, complete with decking, 3.16 tons.

The first bay of the bridge is built on a 2-wheeled trolley, and a long arm, sufficient for the gap to be bridged, is built out as a cantilever on one side, and a shorter counterbalance is constructed simultaneously on the other side of the trolley. When the skeleton bridge is completed, the end bay of the counterbalance is loaded with road bearers till balance is obtained. The bridge is pushed forward by hand power over the gap on a prepared track, and the far side lowered on its abutment. The counterbalance is removed, then the trolley, and the near side lowered on to its abutment and the decking laid. During the advance of the Canadian Corps over the Canal du Nord in September, 1918, a bridge of this type, 108 feet clear span, was erected under heavy shell-fire, and opened for traffic in 12½ hours, a work party of approximately 200 sappers being employed on the construction of the bridge, abutments and approaches. The bridge at this span was good for a distributed load of a trestle as a centre support, it took all classes of transport. The bridges can be built of any span in multiples of 12 feet, but is limited to 120 feet, with distributed load of 41 tons. Immediately these bridges were erected, construction was started on a bridge of a more permanent type, and the Inglis removed in preparation for use in another attack.

The Germans had very large dumps of good squared bridging timber; with these, and I beams, many bridges were constructed. The Canadian Engineer was very much in his element with a cross cut saw, squared timber and some spikes—a welcome change from the old trench warfare days of pick and shovel work.

Another interesting feature of the work of the Canadian Engineers in France was the Corps tramway system. The Canadian is a very practical fellow and believes greatly in labour-saving devices.

Very early in the war the thought came to me, as it did to many others, that railways could, with profit, be much more extensively used, and that even in the forward areas light railway lines could be laid down, over which cars of some sort could be operated, either pushed by hand or drawn by mules, or pulled by engines. As early as March, 1916, the Chief Engineer organized an unofficial unit called the "Canadian Corps Tramways Company". He did this by borrowing suitable men from all sources for the construction of light railways in the forward area. This organization soon demonstrated the practicability of the operation of light railway lines in the forward area, and the value of them in facilitiating the delivery of trench munition, supplies and ammunition, and in the saving in transport and man power thereby effected. At a later date when the practicability and the usefulness of these light railways had been thoroughly demonstrated, their construction was undertaken under G. H. Q. organization on a large scale. In fact, G. H. Q. wished to take over the construction and the operation of all light railways, a policy to which the Canadian Corps persistently refused to agree. We contended that the G. H. Q. organization could construct and operate effectively on to a point where deliveries in bulk could be made in day light by steam. We preferred that the distribution of supplies in our forward areas should be under our own control. After two years work, the organization of the Canadian Corps Tramways Company was approved, although the Sections had been operating for many months unofficially. One Section we called the operating section, and the other the construction section. They constructed maintained and operated all tramways in the forward area, taking over the cars at the transfer sidings, and making deliveries as required. In the Lens area these sections operated and maintained about 75 miles of line in the forward All supplies, trench munition, rations, etc., were sent forward over these lines. The wounded came out by the same means. Every pound of ammunition was sent up by the light railway, and in the end this system became so perfect that in making a relief, units were sent up by this method of transportation and the relieved units brought back to their billets.

It is hard to appreciate the part played by this service in maintaining the moral, strength, and fighting efficiency of the Corps. In the Lens area we were operating nearly 150 small trains a day, and over 2,000 tons of freight was transported daily by this means. But for the tramways all this would have had to be taken forward by horse transport or pack animals, or carried in by hand. The tramways organization developed a wonderful "esprit de corps"; its members sought to increase their freight returns. It is even said that their Manager would halt lorries on the road to find out what they were carrying, and what their destination was. He would then go to the consignor and ask for the business. Our system was a miniature C. P. R. system employing up to date railway methods. Going to the railway yard at Lens Junction you would find a yardmaster, train despatcher, switchman, block signals, etc.

We used these tramways in connection with our gas attacks with great success. The old way of making a gas attack was to instal cylinders in our front line, awaiting a favourable wind before they could be discharged. This involved a great deal of work; and if the wind was unfavourable, as it often was for days together, it gave us a good deal of worry, for fear the Boche might in a raid discover that we had cylinders installed, and as a result of this information subject our trenches to heavy bombardment, possibly breaking the cylinders and gasing our own men. Personally ,I did not like this method of gas attack, and never installed a cylinder in a trench under my control. We fitted up cars capable of taking three tiers of cylinders. These cars would be held in the back area ready to forward. When a favourable time came, they would be run up as quickly as possible to the front area, our front line trenches cleared, the gas from the cylinders released, and the train would be on its way back almost before the hostile artillery opened up.

One cannot leave the question of tramways without mentioning the name of the Tramway Officer, Colonel Rogers, one of the most enthusiastic and capable officers ever serving in the Canadian Corps. There may be some here present who remember Rogers' observation car in which he used to show interested visitors over his lines, also his private car, christened "Coniagas".

Another thing we asked the Engineers to supply and supervise was the camouflaging of gun position, new defensive works, headquarters, etc. Material was manufactured at the Corps Camouflage Park in order to supplement the supply from the Base, and also to insure a more perfect simulation to local conditions. The manufacture of camouflage and its erection was all done under the supervision of the Corps Engineer Camouflage Officer. It gave scope for great ingenuity and many interesting results were obtained.

Frequently reference has been made to engineer stores. It was impossible to purchase any stores or material locally as the country had been stripped early in the war, and the French authorities reserved to themselves everything that was left. In consequence the requirements of the Corps as regards engineer stores had to be foreseen, estimated, demanded many weeks ahead, and obtained through regular Army channels from outside sources. These engineer stores included, cement, corrugated iron, felt roofing, steel joists and rails, posts and wire for entanglements, wire netting, hurdles, canvas and frames for revetting, trench boards, bricks, baths, stoves, ironmongery, timbers of all sizes, electrical stores, mining and tunnelling stores, water pipes and fittings, pumps, and, as the auctioneer says, "other articles too numerous to mention". These stores and materials were received in bulk at Corps Engineer Parks established at broad gauge railheads. From there they were allotted to Corps or Divisional engineer services and transported by light railways, corps tramways, lorry or wagon transport to advanced Corps Engineer Parks, Divisional Parks, Advance Divisional, Brigade and Battalion dumps.

At an engineer park a workshop was established wherein, as far as possible, timber was resawn to sizes required, made up into standard designs for mining frames, revetting frames, trench boards, notice boards, gun emplacements, sectional huts, targets, trench bridges, infantry bridges, artillery bridges, etc. In addition to saw mills, tinsmith and plumber shops, blacksmith shops, machine shops, paint shops, were in operation producing articles which could be obtained in no other way, and were produced here in order to save divisions as much work as possible. At first these shops were operated entirely by "A" category men, but latterly we formed a unit known as the Artisan Company or the P. B. Company, made up of men who had become casualties when engineer units and had been placed in a lower category than class "A". This unit was utilized in running the Corps workshops, thus relieving class "A" sappers for work in the forward area. In this manner N. C. Os and sappers who had previous front line experience were utilized to the best advantage in the construction of "U" frames and revetting and in handling all articles of trench stores with the use of which they were familiar. By standardising designs and concentrating the work in the corps workshops, the output was greatly increased and a big load taken off the Division. The unit performed a good deal of useful work and completely justified its existence.

Another interesting section was the mapping section. Each Brigade and each Division had a small Map Section, but the most of the work was done by the Mapping Section of the Corps. In the Canadian Corps we had a large thoroughly organized Intelligence Section, seeking to get information from the enemy by every possible means, by aeroplane photographs, by reconnaissance in aeroplanes, from infantry and artillery observation posts, from special observation posts, by raids, by questioning former residents of the country, and by every means which the human mind could suggest. This information was put on maps. Each Division employed the same method, so that one Division relieving the other would find itself in complete possession of all the information available regarding the hostile country opposite.

In the early part of the war we had very few maps. I well remember the very rough sketches turned over to us in 1915, when we entered the Hill 63 and Ploegsteert area. If a battalion commander were lucky he might be given a rough map of his front line. His unfortunate adjutant, whether an artist or not, had to make a copy for the company commander. In the later months of the war every officer and every N. C. O., and sometimes every man, was given a map or plan of the area over which he would attack.

There were two other exceedingly important sections of the engineer services, and they were by no means the least interesting; the Corps Survey Section, and the Signallers.

I have not the time to-night to make further reference to either. The work of each would require as much time as I have taken in what I have already said.

Before closing I wish to set forth in some detail the part played by the Engineers in the battle of Bourlon Wood. The Engineer preparations for the Bourlon Wood operations were undertaken on five days notice, and were exceedingly difficult owing to the nature of the ground. On the front over which the Canadians attacked the way was barred by the Canal Du Nord, 100 feet wide, with banks up to 15 feet in height, the water in many places being over 8 feet deep. The ground slopes from the south to the north, and about half of the front over which the Canadian Corps attacked was covered with a difficult marsh, 1000 feet wide in places. The ground on both sides sloped towards the Canal and the bare glacierlike slopes were almost devoid of cover of any sort. The famous feature, Bourlon Wood, dominated the whole situation, and gave observation over all movements, by day, for miles in the Canadian lines. The Canal and the approaches to it were strongly defended by every artifice of barbed wire and machine gun nests cunningly placed. Rows of trenches with splendid gun positions on the Enemy's side. In this retirement to the line of the Canal Du Nord, the enemy had destroyed all bridges over the canal and, on the main roads had blown up huge mine craters showing up clearly in all aeroplane photographs. The front line of the Canadians was roughly parallel to the Canal, and about 500 yards from it. This was only an outpost line, as the whole situation was dominated from the eastern bank of the Canal, and the slightest movement brought heavy shell-fire and machine-gun fire from Boche.

The problems confronting the Engineers in preparing for this attack involved the repair of roads demolished by shell-fire; the pushing forward of cross country tracks for infantry and horse transport to the front line to facilitate the delivery of ammunition, stores, and supplies; the provision of engineer materials of all sorts; the rapid construction of improvised headquarters for battalions, brigades, divisions, etc., and of the dug-out accomodation and shelters of all descriptions. A difficult question was the provision of water supply for the large number of horses, approximately 40,000 assembled in a very congested area.

The problem confronting the engineers in the attack was to get the infantry and the guns over the canal in the face of enemy barrage and to provide sufficient facilities in the way of roads, bridges, tramways, etc., which would ensure the sustained supply of ammunition for the large number of troops engaged. Every detail in the preparations was worked out most carefully, and as it was clear that the enemy's barrage would naturally fall on the line of the Canal and be retained there, the following were provided for:

Seven infantry foot-bridges of an unsinkable type; ten crossings for guns and horse transport (five of which had to be developed at once for heavy traffic, even while the continuous stream of guns and ammunition wagons were pouring over them).

Tramways had to be pushed forward; and water supply had to be developed in the forward area for the hosts of men and horses moving forward on captured ground, concerning which nothing was done.

Provision had to be made for a rapid examination of roads along which the guns would proceed to their new positions; for land mines on the roads demolished by shell fire; a rapid reconnaissance had to be made for concealed mines and bomb traps in dug-outs and cellars, and in all places which would be of value as cover for men. Arrangements had to be made for getting forward the necessary screw-stakes and barbed wire and picks and shovels, tn enable our men to consolidate the position they had gained, and assistance had to be given them in this consolidation.

Before zero hour, 16 miles of roads had been repaired up to the front line, and seven miles of tramways constructed. On these tramways over 3,000 tons of ammunition per day were being delivered to advanced dumps and gun positions; the requisite water supply was provided for the huge concentration of horses, and all necessary arrangements were completed.

After zero hour, all crossings were put through successfully, in spite of the heavy rifle and machine-gun fire. The attack kicked off at 5.20 a.m. and the first guns crossed the Canal at 8.40 a.m. The other crossings were completed at various times during the day, depending upon the fluctuations in the fight and the extent to which the work was exposed to heavy and concentrated shell fire. Owing to the nature of the ground and the heavy traffic which would immediately be thrown upon these crossings, it was practically impossible to consider crossings at any place except where good roads existed. These crossings were well known to the enemy and were naturally subjected to heavy shell fire. Progress was slower in the northern half of the front, as it took a much longer time to clean up machine gun nests in the extensive marsh, and the town of Marquion held out for a long time. The gun positions north of the Sensea Canal were all able to enfilade the Canal for three quarters of the front attacked.

The Engineers went over with the infantry to get their footbridges across: and the engineer wagons with their six horse teams were pushed forward so rapidly in several cases that all the horses were killed by machine guns, and the men got their materials down to the bridge sites by men handling the wagons along after the horses had been killed. In one case, a party of Boche machine gunners who had evidently been overlooked by the mopping up parties emerged from some concealed tunnel or dugout and attacked the engineer party attempting to bridge the canal. The engineer officer in charge took part of his men and beat off the attack, and at the same time kept on with the construction of the bridge without interruption.

The bridges constructed were of all types; pontoon trestle, heavy pontoon, and lastly heavy steel bridges for all traffic. A remarkable record was made in the erection of two heavy steel bridges of 110 feet span, in spite of heavy shell fire and machine gun fire.

The materials for two bridges were got on to the site about 2 o'clock in the afternoon; the approaches were prepared and the bridge erected and open for heavy traffic in 12 hours actual work. This is considered to be a record. In all, three heavy traffic bridges of approximately 110 feet span were placed across the Canal Du Nord, two of them being completed in about 12 hours actual working time, and one in 24 hours time.

By 2.00 p.m. three new pumping installations had been installed on captured ground, and sufficient horse troughs erected to water 5,000 horses an hour. All materials were got forward to the infantry, and the positions gained were consolidated. About three miles of tramways were constructed and brought into operation.

The Battle of Bourlon Wood was an Engineers' Battle. The success of the whole operation depended on the speed with which the necessary crossings of the Canal Du Nord were provided, and the way in which they were maintained and improved during the day, so as to enable the guns and infantry to be maintained in the position which they had reached in their advance.

It was in this battle that a sapper won the V. C. I refer to Captain Mike Mitchell, of the 3rd Battalion of Engineers, who hails from Winnipeg. Capt. Mitchell was awarded the V. C. for conspicuous gallantry and devotion to duty on the nights of October 8th, and 9th, 1919, at the Canal Du L'Escaut, just north east of Cambrai, when his Division (the 2nd Division) got around Cambrai from the North, outflanking it, and by so doing enabled the 3rd Division to push through the town in the early morning of that day. Captain Mitchell led a small party at the head of the first wave of infantry in order to examine the advance bridges on the line of approach, and if possible to prevent the enemy from destroying them. On reaching the Canal he found the first bridge already blown up. Under a heavy barrage he crossed to the next bridge where he cut a number of lead wires. Then in total darkness, and unaware of the position or strength of the enemy at the bridge-head, he dashed across the main bridge over the Canal. This bridge was found to be heavily charged for demolition; and while Captain Mitchell, assisted by his N. C. O., were cutting the wires the enemy attempted to rush the bridge in order to blow up the charges. He at once dashed to the assistance of his sentry who was wounded, killed three of the enemy, captured twelve, and removed the charges which he knew might at any moment have been fired by the enemy.

Up to June, 1917, the day on which the Battle of Messines was fought, the largest mine blown by either the Germans or the Allies on the Western Front was blown at the "BLUFF" during the latter part of July 1916. The events in connection with this, form an interesting story.

In February, 1916, the Germans had blown a mine under that portion of the Bluff nearest to their lines. It might be well to explain that the Bluff is the spoil bank from the Ypres-Comines Canal. Immediately upon blowing the mine in February, they attacked and seized the Bluff; were counter-attacked several times in the following few days, but unsuccessfully. They remained in possession of the Bluff until the next month—March—when they were driven off. The casualties on the British side, resulting from the operations in February and March at this particular point were about 4400. The Canadians took over these lines about the first of April; the 2nd Division extending their lines northward including Mount St .Eloi, and up to the Canal; the 1st Division from the Canal including the Bluff, up to Mount Sorrel, and the 3rd Division, from Mount Sorrel to Hooge.

Towards the latter part of May, the 1st Division turned over Mont Sorrel Defences to the 3rd Division, and it was in this area the Germans made their very violent attack on June 2nd.

To enable the 1st Division to make the counter-attack their troops were withdrawn from the Bluff sector which was turned over to the 2nd Division, the 1st Division not getting back to that area until the latter part of July.

On resuming responsibility for the Bluff Area, I sent for the Mining Officer and asked him the mining situation on the front. He informed me that we were almost sure to be blown underneath the Bluff, and that we might be blown under the Bean and Pollock. Upon this information, instructions were immediately issued to the Brigade concerned to hold the Bluff as lightly as possible, to prepare a crater-jumping party, to place additional machine guns in position to cover the area in front of the Bluff, while the Artillery were asked to lay their S. O. S. night lines to cover the Bluff. The Brigade reported at 8 o'clock one evening that the instructions given had been carried out, when strange to say, the Germans blew their mine that same night at 10 o'clock, making a crater 450 feet long by 160 feet wide. Before the earth had fallen, the crater-jumping party were on their way to consolidate the crater, the machine-guns immediately opened up, while all the artillery in the Division came down with a crash on No-Man's-Land. The Germans no doubt anticipating the same measure of success which accompanied their former effort in February left their trenches in large numbers to once more seize the Bluff. They were caught in the machine gun fire and barrage, and suffered very heavy casualties. This annoyed them very much, and they opened a heavy bombardment on our lines which they kept up practically all night. We were fortunate in getting off with only 42 killed and wounded during that night's operations, a very small number when compared with the number it had cost to hold our lines intact in the previous February and March. There is another curious co-incidence in connection with this event:

Shortly before 10 o'clock on the night in question a young engineer officer accompanied by a wiring party of about 15 was on his way to put out additional wire entanglements east of the Bluff. The sentry on duty told him that he ought to be careful as the Germans were going to blow a mine. The engineer officer asked him when was this mine going up and strange to say answered, about 10 o'clock to-night. The engineer officer wrote a note to his Company Commander setting forth what he had just been told, asked for instructions, and despatched it to his Company Commander. While waiting for the reply, the mine went up, and the orderly who was delivering the message was the only one of the party, not a casualty. The message sent by the engineer officer in question to his Company Commander is on file.

The Germans were so disappointed in their intentions that they delayed re-opening their mining operations in that vicinity. Our miners anticipating such a thing went out to No Man's Land, which was here some hundreds of yards wide, sunk a shaft and were fortunate enough to break into the German's Mine gallery so that the works there definitely passed into our possession. Some may say that this was luck, but it is the luck that usually accompanies foresight, energy and initiative.

In connection with the Engineer's work one should also mention the Search-light Section of the Corps, operated by the engineers.

During the campaign of 1917-18, night bombing was much more extensively indulged in than formerly. The result was that it was interfering very much with the men's sleep even in the rest areas. We were anxious to do something to counteract the success of these raids which were hurting the morale of troops. Aeroplanes do not prefer an area where search-lights are operating. They dislike being caught in the beams because such predictment makes them a better target for the anti-aircraft guns and also for our planes which often went up at night seeking just such a target. G. H. Q. gave us the search-lights and we trained personnel to operate them, using for that purpose P. B. engineers. During the month of September, 1918, I saw 5 hostile aeroplanes brought down at night by our planes; they being first located, and therefore blinded by the search-lights operated by the Canadian Engineers.

The war is over; and in the light of experience gained during the past five years, the Canadian Engineers of the Active (Non-Permanent) Militia are about to be re-organized. There are financial limitations, and no drastic changes are contemplated. It is hoped, however, that it may be possible to build up a strong reserve composed of technically qualified engineers who have seen service in the field, and who in time of need would at once be available for the performance of military duty.

In Canada, works of construction are ever in progress; engineers with practical experience are readily obtained; and in no country in the world is it easier to mobilize at short notice, units required for engineer services. For these and other reasons it is proposed to limit training, in time of peace, to field companies, field troops and Fortress companies; and, for the present at any rate not to proceed with the re-organization of the more highly technical units.

On the other hand, I make the suggestion that to the Corps of the Royal Canadian Engineers, there might be assigned in addition to its military functions, duties not dissimilar to those performed by the engineers of the United States Army. The corps might be charged with the execution of National works, that is to say, the carrying out of river and harbour improvements, the erection of public buildings, the construction of roads, railways and canals, and it might also undertake all coast and interior surveys required for government purposes.

In conclusion, a nation at war must be prepared to make the fullest use of its engineering resources; it must be ready to avail itself of all modern developments in engineering science. "It is therefore of the first importance" (I quote from a recent report on the organization of the Royal Engineers) "that a careful study of the manner in which engineering resources can be utilized in war should form one of the paramount duties of the higher direction of the army both in war and in peace; and that there should exist an organization by which such matters can be definitely brought to the notice of the responsible authorities; together with a machinery by which the whole resources of the engineering profession of civil life can be brought to bear on the solution of military problems and made available in war for the service of the army.")

In concluding, General Currie said:

"People have a natural tendency to lay emphasis on the role played in the war by the infantry, who, after all, do the actual fighting ;and they are sometimes prone to overlook the services rendered by the artillery, engineers, and other important services. The spirit of the engineers was right. I remember that at the battle of Passchendaele we said that we could not fight unless we made roads. We were told that we could not make roads; the Bosche would not let us. Anyway, we said we would try—and we went ahead and did it; the engineers knew that we could not succeed unless these roads were built. One day a working party of thirty men was engaged in the building of these roads. At night only two men were left, but they were still making the road. That was the spirit of the corps.

Many of the engineers are probably wondering what is to become of the Engineer Corps in any reorganization of the militia. This particular matter has not been worked out as yet—not because the good work done by the engineers is not appreciated; not because the corps is not worthy of perpetuation. But in a new country like Canada there is a great deal of construction work going on; roads, bridges and railways are constantly being built; and we have a good many men who are engineers. We have not so many infantry men; so that no considerable time has yet been devoted to the reorganization of the Engineer service. I want to see every unit of engineers perpetuated in some engineer organization; because although many may be good engineers, good bridge builders, good road constructors, and so on, matters of army organization and army supply have to be learned. I would like to see formed a corps of engineers made up of men who would be on the reserve of any militia organization; men who could be called upon for the defence of our country if such a thing became necessary. I say that it is not wise to waste our men. A battalion commander told me that he had six splendid engineers who were killed within a few months of the beginning of the war. These men, to my mind, could better have been in the Engineer Corps. If we had an Engineer Corps in the Canadian reserve militia we could always place our men; we could know who were the best men on water supply, the best men on roads, the best men on bridges. I believe that such a corps should receive every encouragement from the Government; it might be given charge of the planning and actual construction of a great many of our public works. They have the ability to do it; they have the willingness to do it; they could do it cheaper, I believe, than it could be done in other ways. Of course that would eliminate the contractor to some extent, and that may not be a very acceptable thing to everybody. I am not a politician, but they tell me that contractors are good fellows to have around when you want to raise a campaign fund. But I believe that an engineer corps could do a great many of the public works of this country and do it satisfactorily.

I thank you, ladies and gentlemen, very sincerely for your patient hearing. I hope that I have said something which enables you to arrive at a better appreciation of the work of the Canadian Engineer Corps in France." (Applause).

THE CHAIRMAN: We are deeply indebted to Sir Arthur Currie for his able and vivid description of the work done by the engineers in France. There are many prominent engineers and surveyors here; we would like to give them an opportunity of making any remarks they wish to make.

MR. T. FAWCETT: Mr. Chairman, we as an Association are very much indebted to Mr. Currie for his most instructive address. It is a great honour to the Dominion Land Surveyors' Association to have had this opportunity of listening to this able presentation of the subject—the more so because many members of our Association were engineers over in France and took part in that great work. In fact, nearly all the engineers who were connected with the Canadian army were members of our Association, of Provincial Land Surveyors' Association, or of the Canadian Engineering Institute. It was due to the leadership of Sir Arthur Currie that they carried out their work so well. They seemed to receive the inspiration of that motto which has been applied to the British Empire: "What we have we'll hold"; though during the latter part of the war they seemed not only to hold on to the positions they took but to take a great many of the enemy's guns as well. I desire to propose a very hearty vote of thanks to General Currie for his very able address.

THE CHAIRMAN: This motion comes from one of our oldest members; he has passed the allotted age of three score years and ten but is still carrying on active work. I have much pleasure in conveying to you, Sir Arthur Currie, the thanks of this meeting for the address which you have given us. (Applause)

SIR ARTHUR CURRIE: I appreciate the kindly remarks of the proposer of this motion. I assure you that it has been a great pleasure for me to be with you and to have an opportunity of addressing this meeting under the auspices of the Dominion Land Surveyors' Association.

The meeting closed with the singing of "God Save the King."

THURSDAY MORNING SESSION

The meeting was called to order by the President at ten A.M.

THE CHAIRMAN: Our first paper this morning is one on "International Mapping", by Major D. H. Nelles, D.L.S., of the Geodetic Survey.

MR. NELLES: The title "International Mapping" is rather a misnomer. The paper is really a plea for a general system of scales in Canadian topographical maps, and for standard sheets and numbers. I have therefore named the paper: "Standard Scales, Standard Sheets, Standard Numbers, for Canadian Topographical Maps".

A SYSTEM OF

STANDARD SCALES, STANDARD SHEETS, STANDARD NUMBERS, FOR CANADIAN TOPOGRAPHICAL MAPS.

—BY—

MAJOR DOUGLAS H. NELLES, D.L.S., M.E.I.C.

The most important results of the surveyor's work in the field is the placing of **permanent marks** in the ground to fix the position of points on the earth's surface whose distance is known from the equator and from the meridian of Greenwich. The points are also fixed in the third dimension of elevation above the datum of Mean Sea Level. The points control the length and direction of the straight lines joining them. In a new country the lines to be so marked first, are the different kinds of land boundaries, such as, International Boundary Lines, Provincial Boundary Lines, Township Boundary Lines, Road Boundary Lines, Farm Boundary Lines and the subdivision lines by which land is divided into streets and lots, upon which villages, towns and cities grow and come into being.

As the country becomes more thickly settled, there comes the need for more rapid and economical means of communication than that which is afforded by Nature unimproved, so roads are built for vehicle traffic, railroads are surveyed and constructed; rivers are improved so that boats can navigate them; canals are built where they are necessary to overcome rapids and falls or to shorten the route from one place to another. The boundaries of the land appropriated for these means of communication are also fixed.

As the above work progresses, plans are made showing the points fixed, the lines controlled, and the details of the structures built. These plans may be said to be the second most important result of the surveyor's work; for if the mark marking the position of a point is destroyed, the point can be again established in the same place, if the plan is accurately drawn and the correct distances are given.

As the population increases the need is felt for topographical maps of various scales. A **Topographical Map** is the delineation upon a plane surface, by means of conventional signs, of the natural and artificial features of a locality, showing their relation to each other. Every point of the drawing corresponds to some geographic position, according to some method adopted for representing the surface of the spheroid on a plane, which is called the **Projection.** Since it is a representation in miniature, the distance between any two points on the map is a certain definite fraction of the distance between the same points in Nature. This ratio is called the **Scale.** Each point, besides being projected on a horizontal plane, has its elevation relative to a level surface in some way indicated. The level adopted for the map is called the **Datum Plane,** which in Canada is **Mean Sea Level,** and the variation in the vertical element, the modeling of the country, is called the **Relief.** The relief on all modern maps is shown by means of **Contour Lines.** A contour line in physical geography is a line drawn upon a map through all the points upon the surface represented that are of equal height above mean sea level. These points lie, therefore, upon a horizontal plane at a given elevation passing through the land shown upon the map, and the contour line is the intersection of that horizontal plane with the surface of the ground. The contour line of zero, or datum level, is the coastal boundary of any land form. If the sea be imagined as rising 100 feet, a new coast line, with bays and estuaries indented in the valleys, would appear at the new sea level. Were the sea to sink once more to its former level, the 100 foot contour line with all its irregularities would be represented by the beach mark made by the sea when 100 feet higher. If instead of receding the sea rose continuously at the rate of 100 feet per day, a new series of levels 100 feet above one another would be marked daily upon the land until at last the highest mountain peaks appeared as islands less than 100 feet below. A record of this series of advances marked upon a flat map of the original country would give a series of concentric contour lines, narrowing towards the mountain tops, which they would at last completely surround. Contour lines of this character are marked upon most modern maps of small areas, and upon all government survey and military maps at varying intervals according to the scale of the map.

A number of Departments of the Canadian Government are now publishing maps on various scales, some of which are complete topographical maps, others lack contours for information as to levels; and others while they are contoured, lack information in regard to the variety and quantity of forests and trees. The scales upon which they are published are, for the most part, recognized as standard all over the world; they are as follows:—1-1,000,000, 1–500,000, 1–380,360, 1–125,000, 1–62,500, 1–10,000 and 1–1,000; and then there are various maps published for different purposes on scales of 35, 50, and 100 miles to an inch, etc., showing the whole Dominion of Canada, but these do not come under the heading of topographical maps.

In the year 1891 the first important step was taken towards obtaining a more uniform map of the world. In that year the International Geographical Congress at Berne raised the question, and the London Congress of 1895 passed a resolution recommending the scale of 1–1,000,000, or about sixteen miles to the inch, as suitable for a map of the world. This resolution was communicated to the various governments in the hope that this scale might be generally adopted.

It was some time before this resolution produced much effect, but eventually Great Britain published a map of the United Kingdom on this scale, and commenced the publication of maps of Africa and Asia, while France and Germany commenced the issue, and the United States the preparation of maps on this scale. Meanwhile the opinion of experts was coming round to the view that for the map of the world uniformity in many points other than scale is desirable.

At the meeting of the International Geographical Congress at Geneva, in 1908, the subject was again considered, and it was decided to recommend for the 1–1,000,000 scale map the adoption of a uniform design, i.e. that the projection. methods of representing the hills and other details, the conventional signs, amount of detail to be shown, and other points should be similar throughout. The various governments were asked to prepare specimens on the 1–1,000,000 scale to illustrate their views as to style, etc.

Great Britain then invited the various governments to appoint delegates to meet in London in order to consider draft proposals, which had meantime been elaborated, for the preparation of this map and it was the delegates appointed in response to this invitation who met in London, on Tuesday the 16th of November, 1909.

The following countries were represented by delegates: Great Britain, Canada (whose delegate was the late R. E. Young, D.L.S.) Australia, United States of America, Austria-Hungary, France and Colonies, Germany, Hungary, Italy, Russia and Spain.

The result of the work of this committee was the passing the thirteen resolutions regarding the construction of the map, etc. These were signed by each delegate, each of whom submitted a copy of them to his own government by which they were afterwards ratified. In December 1913 another conference was held in Paris and the resolutions passed in 1909 were amended and another one added. The amended resolutions are as follows:—

Extract from

CARTE DU MONDE AU MILLIONIEME

Comtes Rendus Des Seances De La

Deuxieme Conference Internationale

Paris, Decembre 1913

C. TEXTE EN LANGUE ANGLAISE

List of Resolutions

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1. Authoritative Text of the Resolutions.

The English, French and German texts shall all be regarded as official. The only authoritative text of any Resolution, however, will be that in the language of the country in which was held the Conference which drew it up (Paris, 1913).

2. General Resolution.

It is desirable that a uniform set of symbols and conventional signs be adopted by all nations for use on the map of the world on the scale of 1 in 1,000,000 and that the limits of the sheets, etc., shall be uniform (London, 1909).

3. Area of each sheet.

(a) Each sheet of the map shall cover an area 4 degrees in latitude by 6 degrees in longitude (London, 1909).

(b) North of latitude 60 N., and south of latitude 60 S., it shall be permissible to join two or more adjoining sheets of the same zone,(so that the combined sheet covers 12, 18, etc., degrees of longitude (London, 1909).

4. Limits, numbers and references of sheets.

(a) The limiting meridians of the sheets shall be at successive intervals, reckoning from Greenwich, of 6 degrees; and the limiting parallels, reckoning from the Equator, shall be at successive intervals of 4 degrees (London, 1909).

(b) The zones, extending from the Equator on each side to 88 deg. latitude, are given letters from A to V.

The polar areas are lettered Z. The sectors, from longitude 180 deg. E. or W. of Greenwich, are given numbers from 1 to 60, increasing in an easterly direction (London, 1909).

(c) In the northern hemisphere, each sheet shall bear a descriptive symbol composed of the letter N—followed by the zone letter and sector number corresponding to its position, thus: N. K.—12.

In the southern hemisphere, the letter S shall replace the letter N (Paris, 1913).

(d) Each sheet shall, in addition, bear the name of the locality or most important geographical feature on the territory represented, and also the geographical co-ordinates of its central point (London, 1909).

(e) Each sheet shall bear the French heading,

Carte Internationale Du Monde Au 1 000 000e

as shown on the conventional sign plate, and under it a translation of this heading in the language of the country publishing the sheet (Paris, 1913).

(f) Each sheet shall show a small index diagram, giving the names and numbers of the eight surrounding sheets (London, 1909).

(g) Each sheet shall have a small index diagram, at 1/10 of the scale, showing the boundaries, and if possible the names of the States, Colonies or Protectorates governing the territories which are covered by the sheet (Paris, 1913).

(h) At the foot of each sheet shall be printed a reference, explaining the conventional signs used in that sheet. The reference shall be in the language of the country which publishes the sheet, and in at least one of those three languages in which the Resolutions of the London Conference were printed (Paris, 1913).

(i) Each sheet shall bear a list of the principal sources of information from which it is constructed (London, 1909).

(j) Each sheet shall show the year of compilation, the date of publication, if space permits, and immediately under the south east corner of the border, the month and the year in which it was printed, thus:—12, 1913 (Paris, 1913).

5. Degree lines and margins.

(a) Each degree line shall be drawn right across the sheet (London, 1909).

(b) In the east and west margins of each sheet the parallels shall be numbered in the ordinary way 0 deg. at the Equator to 90 deg. north or south. Outside the east margin the latitude calculated from 0 deg. at the south pole shall be added in blue.

In the top and bottom of each sheet the meridians shall be numbered in the ordinary way from 0 deg. to 180 deg. east and west of Greenwich. Above the top margin the same meridians shall be numbered, in blue, with the corresponding longitude calculated from 0 deg. to 60 deg. eastwards from the antimeridian of Greenwich (London, 1909).

(c) For convenience of reference the side margins of each sheet shall be provided with small letters, a, b, c, etc., from top to bottom. There shall be two such letters for each strip of 1 degree in width bounded by two consecutive parallels.

Similarly vertical strips bounded by two consecutive meridians shall have as reference Roman numerals (I, II, III, etc.), from left to right, two to each strip in the upper and lower margins, (see conventional sign plate) (Paris, 1913).

6. Projection.

(a) It is necessary that the projection should fulfil the following conditions:

i) The meridians should be straight lines.

ii) The parallels should be arcs of circles of which the centres should lie on the prolongation of the central meridian (London, 1909).

(b) In view of the fact that on the scale proposed several suitable projections differ but little from each other, and that the contraction and expansion of the paper on which the map is printed affect all lengths on the map, and prevent it from being in fact exactly either orthomorphic or equivalent, it is not necessary to lay great stress upon the selection of a projection which has the best properties as to conformity or equivalence. It is therefore agreed to select a projection which can be easily constructed, and permits every sheet to fit exactly together with the four sheets adjoining its four sides.

A modified polyconic projection, with the meridians as straight lines, satisfies these two conditions (London, 1909).

(c) The projection shall thus be constructed: Each sheet shall be plotted independently on its central meridian. The central meridian shall be a straight line marked off in degrees.

Through the points so marked circles are drawn to represent the parallels. The centres of the circles are situated on the prolongation of the central meridian. The radius of any circle is equal to v cot — where v, is the normal terminated by the minor axis, and — is the latitude of the parallel represented.

Along the limiting parallels, i.e., along the circles forming the north and south edges of the sheet, the degrees of longitude are marked off in their true lengths to scale.

Corresponding points on the limiting parallels are joined by straight lines; these straight lines represent the meridians.

The meridians which are true to scale are those which are 2 degrees to the east and west of the central meridian respectively. The actual length of the central meridian is the true length to scale, minus the small correction which is necessary to effect this, and is shown in a special table (London, 1909).

7. Hypsometric colours and contours.

(a) The map shall be a hypsometric map, i.e. the successive altitudes shall be indicated by a system of colour tints.

There may, however, be published, other editions without altitude tints, and these may be completed by tints, or by additions required for other purposes (London, 1909).

(b) Normally, contours shall be drawn at vertical intervals of 100 metres reckoning from mean sea level. The 200, 500, 1000, 1500, 2000, 2500, 3000. 4000, etc., contours, called principal contours, must always be shown.

In flat country, auxiliary contours may be interpolated, if needs be, between the principal contours, but they shall be at a regular vertical interval of 10, 20, or 50 metres.

It is desirable to show the 100 metres contour whenever it is possible to do so, (Paris, 1913).

(c) Minor features of importance, which would not be shown by contours may be represented by shading or by hachures (Paris, 1913).

(d) In parts not completely surveyed, the relief may be shown by broken contours, by shading by hachures, according to the degree of accuracy of the data available. A sheet so compiled shall be marked: Provisional Edition.

No system of showing relief shall be used, if the information is not sufficient to justify it (Paris, 1913).

(e) Under-water features shal be shown in the same way as land features, that is to say by contours. Figures should be added to the system of contours particularly at maximum depths. The datum level shall be mean sea level, or the surface level of a lake at a given date (Paris, 1913).

(f) Principal sea and lake-bed contours shall be drawn at depths of 100, 200, 500, and 1000 metres, and then at 1000 metres intervals.

Auxiliary sea and lake bed contours may be added, as necessary, between 1 and 100 metres, at the same regular vertical intervals (10, 20, or 50 metres) as on land (Paris, 1913).

(g) The representation of the sea-bed by contours shall be supplemented by soundings, particularly at great depths (Paris, 1913).

8. Lettering.

(a) The lettering shall be in varities of the Latin characters (London, 1909).

(b) Names referring to hydrography and routes of communication shall be in sloping characters. All other names shall be in upright characters (Paris, 1913).

(c) The attached general types of standard lettering shall be used. The guage of the letters is left to the discretion of the Service or Establishment which reproduces the map (Paris, 1913).

(d) All figures denoting heights shall be upright. Figures denoting depths shall be sloping (London, 1909).

(e) The lettering used for scales, sub-titles and other explanatory matter appearing outside the sheet lines of the map, shall be in upright Roman capitals and lower case (London, 1909).

9. Spelling and Transliteration of Names.

(a) In independent or self-governing countries, in which the Latin alphabet is in habitual, or alternative, use, the spelling of place names shall follow authorized custom (Paris, 1913).

(b) The spelling of the place-names in a colony, protectorate, or possession, shall be that of the authorized transliteration into Latin characters in use in the governing country, provided that in the latter the Latin alphabet is in habitual, or alternative, use (Paris, 1913).

(c) When large localities and other features of geographical importance have, in addition to an authorized name, a distinctly different name in common use, the latter should be shown in small type either below, or by the side of the authorized name. A sheet upon which some geographical features extend over two or more countries, shall show in each country the name of the feature in the language of that country (Paris, 1913).

(d) Each sheet shall have an explanatory table showing the Latin characters which best represent, in the three languages in which the Resolutions of the London Conference were printed, the phonetic value of the letters used on the sheet (Paris, 1913).

(e) It is desirable that European and other governments which do not use the Latin alphabet should publish in Latin characters, an authorized system of transliteration (Paris, 1913).

(f) For such countries as have no alphabet, but have a Post or Customs service, in which the Latin alphabet is used, the spelling in use in such service shall be adopted (Paris, 1913).

(g) For countries where there are no such services, and for every country in which the government is unable to draw up the system of transliteration mentioned in paragraphs (e) and (f), such system shall be established by the country or countries which reproduce the sheets (Paris, 1913).

10. Conventional Signs and Colours.

(a) Hydrographic features shall be in blue. Water shall be shown by a uniform tint, and not by waterlining.

A distinction shall be made between perennial streams and those which are sometimes dry.

Wherever possible, a special sign shall show those reaches of a river which can carry ordinary canal traffic.

Wherever possible, falls, rapids, and other obstructions to navigation shall be shown (Paris, 1913).

(b) Principal contours shall be shown in continuous and auxiliary contours in dotted line so drawn as to appear like a fine continuous line. Contours shall be printed in black. Heights and the points to which they refer shall be in black.

Sea and lake-bed contours shall be drawn in precisely the same way as land contours and shall be in black. Wherever they cannot be regarded as final, they shall be shown in broken line, the unbroken portions being long for principal contours and short for auxiliary.

Soundings and the points to which they refer shall be in black, as are heights on land (Paris, 1913).

(c) Roads shall be in red. They shall be divided into three classes, which shall be defined in the reference. Normally the heaviest line will represent the most important roads, and the lightest the paths or tracks; but it is recognized

(d) Railways shall be in black. Normally the two principal signs will

that no fixed rule can be made to apply to all cases (Paris, 1913).

indicate railways of respectively two or more tracks, and one track of the normal gauge of the country; the third sign will indicate a light or narrow gauge railway. In countries where many gauges are in use, a wider signification, which should be explained in the reference, may be given to the signs (Paris, 1913).

(e) The towns on each sheet shall be divided into not more than six classes. Wherever possible they shall be shown true to scale. Their relative administrative importance shall be shown by difference of symbol (Paris, 1913).

Their relative importance on other grounds shall be shown by difference of lettering. It shall be legitimate for each country to assess this relative importance according to population, commerce, or historical interest, or according to a compromise between these various factors. A note shall be added to the bottom of each sheet to explain the method of classification. Where portions of several countries appear on the same sheet the principle adopted shall be shown for each country (Paris, 1913).

(f) Telegraph lines shall be in red, and submarine cables in black, (Paris, 1913).

(g) A special sign shall be used to denote large sea ports with quay accommodation for ships drawing not less than 6 metres (Paris, 1913).

(h) Variations in the surface level of large lakes shall be shown by a broken blue line for the water edge (Paris, 1913).

(i) The name of each feature shall be in the same colour as the feature itself (Paris, 1913).

(j) Features which appear on the accompanying reference shall be shown by the conventional signs provided for them. Other features may be shown by other symbols chosen by the Service or Establishment which reproduces the map (Paris, 1913).

(k) The hypsometric tints shall be those of the attached scale. Each zone bounded by two successive principal contours shall have one distinct tint of the scale.

The zone 0-200, in which the 100 metres contour is to be drawn whenever possible, shall be an exception to the above rule, the tint being sub-divided into two separate shades of green. Where the 100 contour cannot be inserted the whole zone 1-200 shall have the darker green shade corresponding to the tint for the zone 0-100.

The zone 200-500 shall also be an exception to the above rule. Whenever the 300 and 400 contours can be drawn, three progressive shades of yellow shall be used to define the zones 200-300, 300-400, and 400-500.

The zone 500-1000 shall be yet another exception. Whenever the 700 contour can be drawn, two shades of the special tint for 500-1000 shall be used for the zones 500-700 and 700-1000 respectively.

In regard to the above cases, whenever the 300, 400, or 700 contours cannot be drawn, there shall be used for the zones between those contours which are drawn that shade which represents the higher altitude—that is to say the darker of the shades given in the attached scale for the zone between the principal contours in question.

The tints of the scale proper to the height above mean sea level shall not be used above the line of permanent snow on glaciers or on lakes. Glaciers, on which relief may be shown by blue stump shading, shall be on a white ground, and lakes shall be given the same uniform blue wash as is used for the first sea tint (zone 1-200, see below).

(l) Seas shall be given a blue wash, darkening with the depth. Six tints form a scale sufficient to reach the greatest depths.

They shall be defined as follows:

1st	tint,	depth	0-200 m.
2nd	"	"	200-500
3rd	"	"	500-1000
4th	"	"	1000-3000
5th	"	"	3000-5000
6th	"	"	below 5000 m. (Paris, 1913).

(m) Ice caps shall be shown in the same manner as glaciers and perpetual snow, that is to say, they shall be on a white ground and shall be contoured in black (Paris, 1913).

11. Scales.

(a) A scale of kilometres shall be drawn on each sheet (London, 1909).

(b) An additional scale of miles, or other national unit, may be drawn if required (London, 1909).

(c) A scale of sea miles (1 sea mile = 1852 m.; or the mean value of a minute of meridional arc) shall always appear on such sheets as show any portion of the sea (Paris, 1913).

12. Heights.

(a) The heights above mean sea level shall be shown in metres (London, 1909).

(b) The values in feet, or other national unit, may be added to the nearest unit, if desired (London, 1909).

(c) The heights of the mean levels of the surfaces of lakes and inland seas above mean sea level shall be given (London, 1909).

(d) The datum level both for height and depth shall be the mean sea level, deduced in each country from tidal observations on its own coasts (London, 1909).

13. International Boundaries.

(a) International boundaries as shown shall agree with the plans and documents attached to the diplomatic instruments which concern them. Their position shall first be approved by the proper State departments of the countries in question before they are dealt with by the department which reproduces the map (Paris, 1913).

(b) A special sign shall be used to define those boundaries which are not properly defined or are still in dispute. Along this sign shall be written the names of the State which proposes that position of the boundary (Paris, 1913).

(c) When an international boundary previously under dispute is settled by agreement, the countries concerned shall inform the Central Bureau of such agreement. The Central Bureau shall then take steps to communicate the agreement and its effects to all consenting countries (Paris, 1913).

14. Preparation and Publication of Sheets.

(a) It is understood that each State which possesses a suitable cartographical establishment shall prepare and publish the sheets which include the whole or part of its territories, except in so far as this principle is qualified below (Paris, 1913).

(b) The strict application of the foregoing principle would necessitate a duplication of certain sheets. In such cases it is desirable that neighbouring countries should come to an agreement as to the respective sheets which each shall prepare (Paris, 1913).

(c) The Conference lays down no rule as to the reproduction of the sheets corresponding to countries which have no cartographical establishments, except in so far as the preceding Resolutions may apply (Paris, 1913).

(d) A special Sub-Committee has already reached an agreement as to the division of the sheets of Africa. It is decided that the work shall be divided in accordance with the diagram prepared by the Sub-Committee, and a copy of this diagram is included in the present Resolutions (Paris, 1913).

(e) Such supplementary editions of the 1 : 1 000 000 map produced by various countries as do not practically conform to the decisions of the Conference shall not be prepared as forming part of the international map of the world (Paris, 1913).

(f) A general price, which shall hereafter be fixed, shall be charged for each sheet of the map. The selling price between Governments shall be a third of the fixed price (Paris, 1913).

(g) Each sheet shall be printed upon paper of a special size; the dimensions being 80 by 65 centimetres (Paris, 1913).

(h) A State which is about to undertake the preparation of a sheet shall inform the Central Bureau of its intention, in order that the latter may make it known to other states and to cartographical establishments (Paris, 1913)

Colonel C. F. Close, C.M.G., R.E., in his "Text Book of Topographical Surveying", describes the method for numbering maps adopted by the British Government as follows: "It has been decided that, in future, all maps of Crown Colonies or British Protectorates which are ¼ degree, ½ degree or 1 degree square, with meridians and parallels for their edges, shall be numbered according to the system approved by the International Map Committee in 1909. In this system each of the 1-1,000,000 map sheets covers an area of 4 degrees in latitude by 6 degrees in longitude, the North and South edges being at every 4 degrees reckoning from the equator, and the East and West edges at every 6 degrees reckoning from the anti-meridian of Greenwich (180 degrees East or West of Greenwich). There are, therefore, in each hemisphere 22 sheets, lettered A to V along any given meridian, and 60 sheets numbering 1 to 60 along any given parallel." The system is shown for North America in diagram No. 1 and for Canada in Diagram No. 2.

"Each sheet is called "North" or "South", according as it is North or South of the equator, and is further defined by its latitude letter and longitude number. Thus, the sheet which covers the southern part of Greenland would be labelled "North P-23".

"Each of the sheets on the scale of 1-1,000,000 covers the same area as 24 sheets, each 1 degree square, on the scale of 1-250,000. These latter sheets are indexed as per diagram No. 3, so that the description of one of the 1-250,000 sheets of Greenland, according to this system, would be North P-23/D".

"Each sheet on the scale of 1-250,000 covers the same area as 4 sheets each ½ degree square, on the scale of 1-125,000, these sheets are numbered as per diagram No. 8.

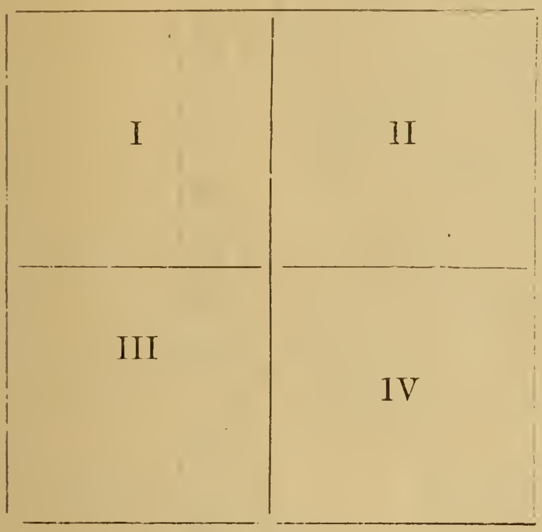


DIAGRAM NO. 8

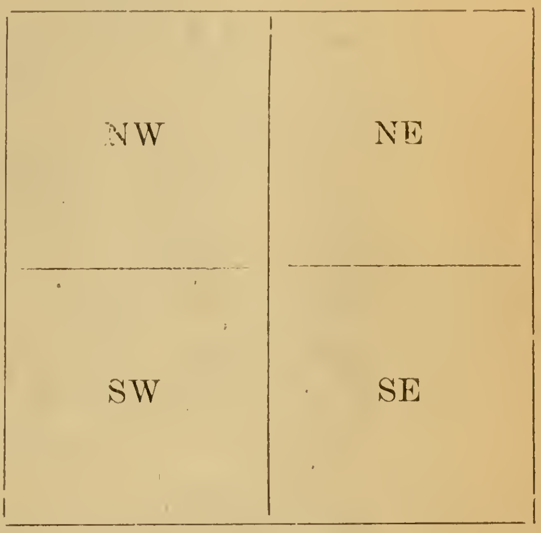


DIAGRAM NO. 9

The description of the 1-125,000 sheets of Greenland is therefore "North P-23/D-111.

"Each sheet on the scale of 1-125,000 covers the same area as 4 sheets, each ¼ degree square, on the scale of 1-62,500. The latter sheets are indexed as per diagram No. 9, so that the description of one of the sheets of Greenland on the scale 1-62,500 is North P-23/D-111-SE".

In regard to the progress of the 1–1,000,000 World Map, Great Britain has mapped the whole of the United Kingdom and part of Africa and Asia on this scale. France has mapped part of France. Germany has made a start in Germany and has finished some sheets of a part of China. The United States has started 12 or 15 sheets, and finished 3 or 4. Canada has not yet started the publication of maps on this scale, because the contour or level information is not yet available. Topographical contoured maps of Canada have only been made of comparatively small sections of the country, which are scattered from the Arctic Ocean to the 49th Parallel and from the Pacific to the Atlantic Ocean. The Canadian International Boundary Commission have mapped approximately 10,000 square miles of Canadian territory along the International Boundary Line and an additional 36,000 square miles of the United States territory in South Eastern Alaska. Other departments of the Government have mapped various amounts in different parts of the country as the various needs arose.

The system herein proposed for Canada, in order to co-ordinate the work of the various Departments, is much the same as that adopted by Great Britain, but is modified and made simpler by referring all scales as directly as possible, back to a degree of the International World Map sheet and giving each scale a distinctive name. Diagram No. 1 shows the International World Map sheets for North America. Diagram No. 2 shows the same for Canada on a larger scale.

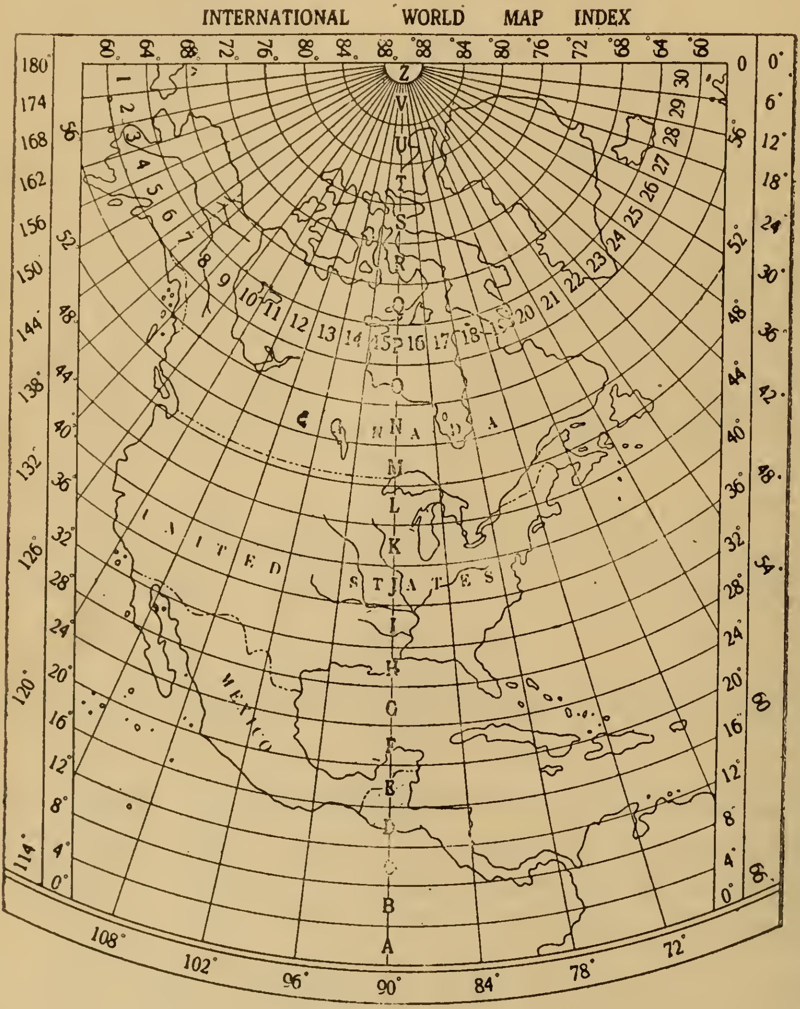


DIAGRAM NO.1.

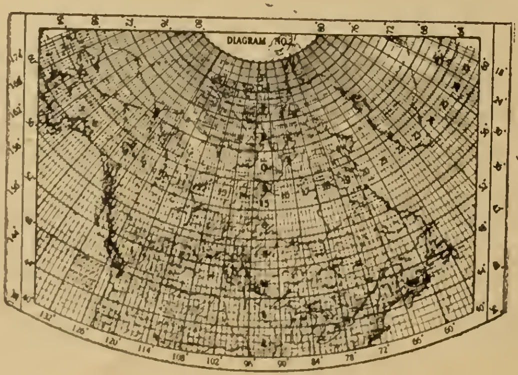
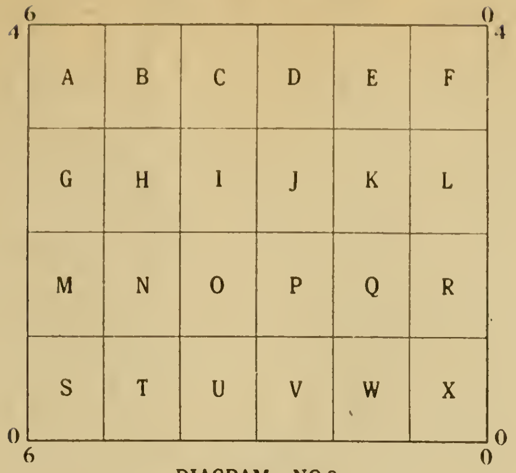


DIAGRAM NO. 2

1-1,000,000 SCALE SHEET
INDEX OF DEGREES



A	B	C	D	E	F
G	H	I	J	K	L
M	N	O	P	Q	R
S	T	U	V	W	X

DIAGRAM NO.3

Diagram No. 3 shows a World Map sheet divided into degrees and the degrees numbered on the British system. Taking up the various scales separately and making the representative sheet of each scale include the latitude and longitude of the building of the Geodetic Survey of Canada, Ottawa, we would have.

The 1-500,000 Scale.

The distinguishing name for this scale would be "Eightmile". It would be published in 6 degree blocks or ¼ of a World Map sheet. The name of this sheet would then be:—

Eightmile .... Degrees MNO, STU
World Map .... North L-18

The 1-375,000 Scale.

The distinguishing name for this scale would be "Sixmile". It would be published in 4 degree blocks or 1/6 of a World Map sheet. The name of this sheet would then be:—

Sixmile .... Degrees OP, UV
World Map .... North L-18

The 1-250,000 Scale.

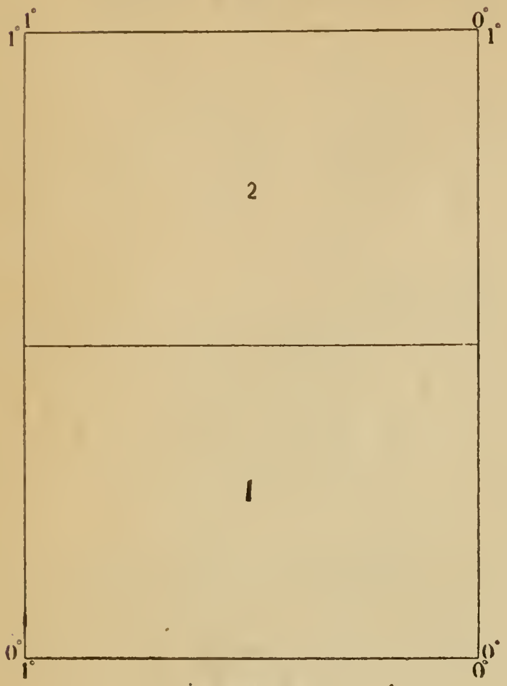
The distinguishing name for this scale would be "Fourmile". It would be published in 2 degree blocks or 1/12 of a World Map sheet. The name of this sheet would then be:— .

Fourmile .... Degrees OP
World Map .... North L-18

The 1-187,500 Scale.

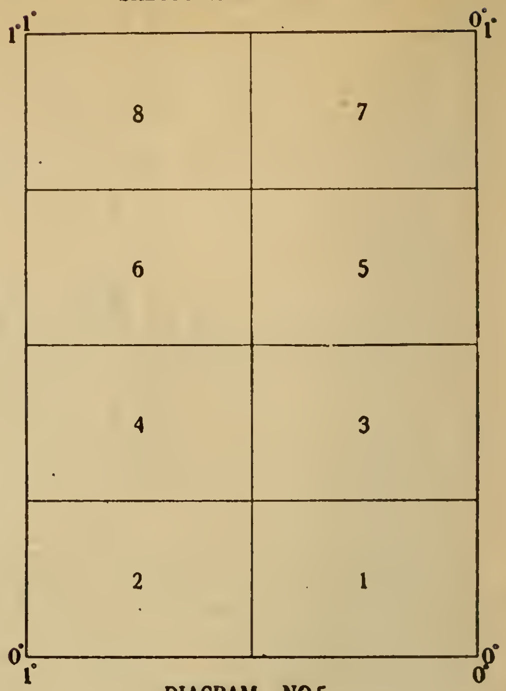
The distinguishing name for this scale would be "Threemile". It would be published in two-degree blocks or 1/12 of a World Map sheet. The name of this sheet would then be:—

Threemile ....Degrees OP
World Map .... North L-18



1-125,000 "TWOMILE" SCALE INDEX SHEETS 30' LAT. 30' LONG.

DIAGRAM NO.4



1-62,500 "MILE" SCALE INDEX SHEETS 15' LAT. 15' LONG.

DIAGRAM NO.5

The 1-125,000 Scale.

The distinguishing name for this scale would be "Twomile". It would be published in ½ degree blocks, as per diagram No. 4.

The name of this sheet would then be:—

Twomile	1
Degree	0
World Map	North L-18

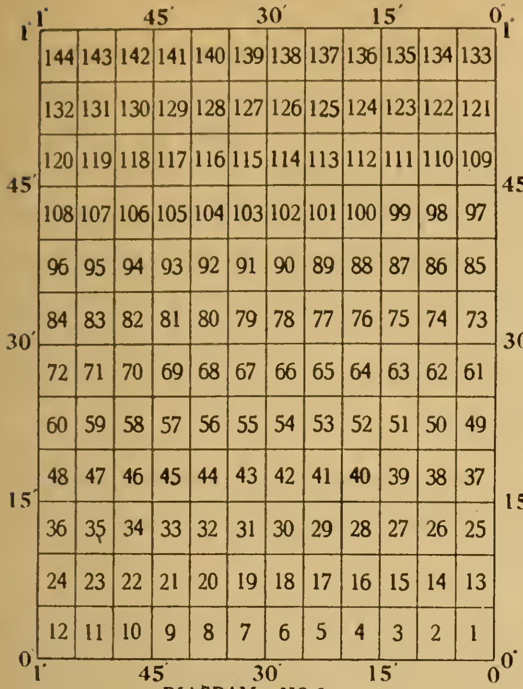
The 1-62,500 Scale.

The distinguishing name for this scale would be "Mile". It would be published in blocks 15′ in latitude and 30′ in longitude or 1/8 of a degree as per diagram No. 5.

This is the same size of sheet that the Department of Militia & Defence are publishing their mile to an inch maps, so that they could be brought into this system by merely changing the numbering. The name of this sheet would then be:—

Mile	4
Degree	0
World Map	North L-18

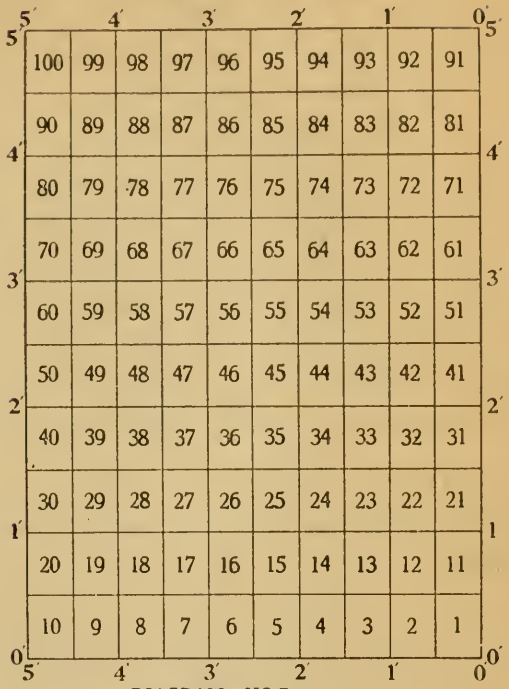
1-10,000 "DISTRICT" SCALE INDEX
SHEETS 5' LAT. 5' LONG.



144	143	142	141	140	139	138	137	136	135	134	133
132	131	130	129	128	127	126	125	124	123	122	121
120	119	118	117	116	115	114	113	112	111	110	109
108	107	106	105	104	103	102	101	100	99	98	97
96	95	94	93	92	91	90	89	88	87	86	85
84	83	82	81	80	79	78	77	76	75	74	73
72	71	70	69	68	67	66	65	64	63	62	61
60	59	58	57	56	55	54	53	52	51	50	49
48	47	46	45	44	43	42	41	40	39	38	37
36	35	34	33	32	31	30	29	28	27	26	25
24	23	22	21	20	19	18	17	16	15	14	13
12	11	10	9	8	7	6	5	4	3	2	1

DIAGRAM NO.6

1-1,000 "CITY" SCALE INDEX
SHEETS 30" LAT. 30" LONG.



100	99	98	97	96	95	94	93	92	91
90	89	88	87	86	85	84	83	82	81
80	79	78	77	76	75	74	73	72	71
70	69	68	67	66	65	64	63	62	61
60	59	58	57	56	55	54	53	52	51
50	49	48	47	46	45	44	43	42	41
40	39	38	37	36	35	34	33	32	31
30	29	28	27	26	25	24	23	22	21
20	19	18	17	16	15	14	13	12	11
10	9	8	7	6	5	4	3	2	1

DIAGRAM NO.7

The 1-10,000 Scale.

The distinguishing name for sheets on this scale would be "District". They would be published in 5′-blocks of which there are 144 to a degree. They would be numbered as per diagram No. 6. The name of this sheet would then be :—

District	57
Degree	0
World Map	North L-18

The 1-1,000 Scale.

The distinguishing name for sheets on this scale would be "City". They would be published in 30″-blocks of which there would be 100 sheets in one District sheet, as per diagram No. 7. The name of this sheet would then have to include the District sheet and would be :—

City	79
District	57
Degree	0
World Map	North L-18

The size of the World Map sheet which contains Ottawa, is very nearly in latitude 17½ inches, South longitude 19 inches and North longitude 17½ inches, which is a very convenient sized map. In suggesting a size for the first five smaller scales mentioned, the divisions have been made so as to make them all approximately this size. The division taken for the 1-62,500 scale, gives a sheet 24¼ inches in South longitude by 17½ inches in latitude, which is nearly the same as the others, so that they could all be printed on the same sized paper. The size of the District and City sheets in this latitude is 25½ inches by 36½ inches, which is approximately the same size as the British town maps. If the maps of Canada were to be standardized upon the above system, the Sixmile and Threemile scales would probably be taken from the list as the scale either above or below would be able to perform the function required; for instance, the Post Office Department use the Sixmile scale as a base map upon which to mark rural postal routes; for this purpose the Fourmile scale would do equally as well. For the purpose of letting contracts for rural or other routes for carrying mail or packages, a large scale topographical map would be used which would show in detail the undulations and grades of the surfaces over which roads pass, their bends and their relative differences in length, so that the difficulties in travel on competing roads could be readily ascertained from the map.

THE CHAIRMAN: This paper comes at an appropriate time, when so much interest is being taken in map making. The meeting is open for discussion.

MR. RANNIE: There might be some objections to the scheme which Mr. Nelles has outlined. In the first place, maps which are made for certain specified engineering features do not occupy the whole of one of the sheets into which the world has been so divided. It is quite easy to imagine that one small corner of a sheet might be occupied by some feature, and if that system were rigidly adhered to we would have one complete sheet showing just a very small part of the country; and in such cases the map makers might be inclined to increase the size of their sheet in order to save quite a little expense. If these things are permitted they rather spoil the effect of the whole thing; it is not desirable to have one sheet that is half as big again as your standard plan. I have in mind the standard topographic maps of Nova Scotia. In order that they may not have too many sheets, the sheets are somewhat irregular in size. In some of them the features shown on one sheet are duplicated on another for the sake of clearness. Suppose a little piece of the southwestern corner of Nova Scotia came on another sheet. It would certainly not promote clearness if that little piece were to occupy a space all by itself; because it is evident that when a small piece is thus separated the mind cannot so easily grasp its relation to the other parts as when it is joined on to the other part. In some cases, therefore, and for certain parts of the country, this system might not work out very well. As an example, take Nova Scotia, which is certainly not regular in its outlines. But there is no doubt that some such system as has been outlined here would be of great advantage for any topographic maps, and I am glad that this paper has been given at this meeting of the Dominion Land Surveyors' Association.

MR. NELLES: All I can say with regard to Mr. Rannie's objection is that if a little piece of Nova Scotia was stuck on one corner of the map the surveyors might not be all interested; but there is an ocean there, and these maps provide for soundings and contours of the ocean bed, which might be of a great deal of interest to other people. These sheets are small and easily handled, and if a person is going out on a reconnaissance or triangulation and covering large stretches of country, it is certain that he will not take only one sheet with him. He will take several sheets, and if he wants to make accurate measurements he will put them all together so that that little stretch of Nova Scotia would be mounted and connected up with the other sheets. The projection provides that all these sheets shall fit absolutely together, and on the sheet showing the sea, there would probably be many interesting sea features or under-sea features shown. Then, again, there is the principle that common sense should govern, and the old saying that exception proves the rule.

THE CHAIRMAN : Perhaps Dr. Deville would make a few remarks on this subject.

DR. DEVILLE: I do not know that I have very much to say on this subject; we have not done anything about international maps—as yet, anyway. But I would like to say a few words on the subject of scales. The scales that we have adopted here for topographical maps are 62,500; 125,000, and so on. They are approximately a mile to an inch, two miles to an inch—not exactly, but pretty nearly. We have adopted these simply because they have been adopted in the United States; we have just followed suit. I am not at all satisfied that this was the best solution. To my mind, if you have a map with British measures you had better stick to it right through and make your scale miles to an inch, or whatever it may be—it might be a fraction of a mile to an inch. I do not see that there is much advantage in using decimal scale on a map on which all measures are in British measures. It is true that for heights you might use a scale decimally divided, but you could not use any scale with decimal division to measure distances. I do not, therefore, see much advantage in adopting this hybrid system of decimal scale on maps with British measures. Perhaps it would be presumptuous for me to pass upon the work of the Geographical Congress and the conclusions which they arrived at. I shall not do so; but perhaps I may be allowed to make a few observations.

This system of sheets for showing elevation is very effective in certain cases. If you have mountains near the sea, for instance, you have a blue tint for the water, green for the low lands, and a brown tint growing in intensity as the ground rises. This is certainly very effective, but it is not effective everywhere. Take, for instance, a high plateau like the western plains of Canada; there you have a brown tint over the whole of the sheet with hardly any variation. That would have very little meaning. Then, another difficulty is that you cannot use colours for showing other things. You cannot use them, for instance, to show woods, which is a very important thing to show.

Of course, these maps are printed by the Geographical Services at their own printing establishments, and it does not matter much to them what is involved in the printing of a map. The costs are not generally calculated, and they can always manage to get the map out in some way. But if you had to get out an international world map of Canada and have it printed at the printing bureau, the charge for printing it would open your eyes. The printing of sheets is a very complicated and difficult operation in lithography. If you want to print each tint separately, for some of these maps fifteen or more printings would be required and for each printing you would have to prepare plates. The preparation of these plates is by means of what they call set-offs. You just get a print in powder on a stone and on that print you paint out everything where you do not want to have a tint. After that you transfer a ruling from an engraved plate to that stone. That is a process which is not very easy, and you are never sure that it will succeed. Sometimes you go wrong in the transfer, and you have to have a new plate and start all over again; and that takes time. You can save time by printing several tints from one plate; that is, transfer one tint first; then paint your stone again and transfer another tint on top of that. In this way you can manage to print three tints from one plate, but of course that increases your difficulties. Anyway, you can see what it means to print one of these maps; it is not an easy matter. My idea is not to find fault with the map which has been suggested but merely to point out that it is not a simple matter to publish these international sheets.

MR. NELLES: I am in perfect agreement with Dr. Deville in regard to putting the tints on the map; I myself do not like them. But I do not think that the British Government intends to put them on the smaller scale than the one-millionth map. These maps have contours as well as tints; the smaller scale maps would have contours only. In regard to the different scales that have been spoken of all these scales are in use in Canada to-day by different departments of Government; they are all multiples of the one-millionth scale and are being used also by the United States and by the British Government in the mapping of the colonies—Africa and India. There is a meter natural scale on the millionth map and also a scale of miles; you can take whatever measurement you wish. On the natural scale you can take any measurement; you can have a scale of links, feet, yards, or any unit you wish.

THE CHAIRMAN: If that ends the discussion, we will go on with our next paper. It is on "Forestry Reconnaissance", and will be given by Mr. bridge was similar in many respects, with the exception that instead of work H. Claughton-Wallin, F.E., of the Forestry Branch.

FOREST RECONNAISSANCE.

—BY—

H. CLAUGHTON-WALLIN, FORESTRY BRANCH.

On the back of the program for this meeting has been printed a verse from "The Canadian Pioneer Surveyor", by Mr. Purser,

> "Intrepid brother to the wilderness, you have tracked our ancient fastness,
> You have measured out its greatness in your stride,
> You have searched for all its features, revealing all its vastness,
> With your faith in old Polaris for a guide."

This beautiful little piece of poetry might, I think, just as well have been entitled "The Canadian Pioneer Forester". We, the surveyor and the forester, are both brothers of the wildness; be we young or old, at the first sign of Spring we hear the call of the mountains, the forests, and the plains, we long for the howls of the wolves at night and the cries of the loon at dawn; we long for the scent of labrador tea and of spruce boughs; we long for campfires and long strings of pack ponies, for our instruments and our tents; we long for everything connected with the great outdoors, except perhaps the mosquitoes and the black flies. Pioneers we are, the land surveyor with his transit and his corner posts, the forester with his compass and calipers.

When Mr. Akins did me the honour of asking me to read a paper to this Association, I was at first a little doubtful about the subject I should choose. Should I talk about scientific forestry, as, for instance, the different silvicultural systems, preparations of working plans, forest researches, etc., or should I select pioneer forestry such as forest reconnaissance. I chose the latter as it brings us in common ground, the exploration of practically unknown tracts of the Dominion. I believe that a thorough understanding by the members of each profession of the duties of the other will lead to a very beneficial co-operation between them.

The Forest Surveys undertaken by the Forestry Branch can be classified as,—

1. Extensive forest surveys or Forest Reconnaissance.
2. Intensive Forest surveys.

Reconnaissance is a preliminary survey of a limited degree of accuracy, while an intensive forest survey, as the name implies, requires much more detail and accuracy in the gathering and compilation of all data.

The reconnaissance system of examination has been used for a number of years by the Forestry Branch to secure information of a general nature in regard to the forest cover on and the possible silvicultural or agricultural values of Dominion lands and to determine the advisability of including certain areas in permanent forest reserves.

The policy of the Government is that lands which are unsuitable for agricultural purposes, but which are important watersheds or valuable to the adjacent community and the country as a whole on account of their timber resources should be included in forest reserves for the purpose of insuring regulation of the stream flow and a perpetual supply of timber.

The principal object of our reconnaissance surveys has accordingly so far been to classify the land in regard to its relative value as agricultural land or forest land, and to locate the boundaries of any area which on account of its character it is deemed advisable to recommend for inclusion in a forest reserve.

The Forest Reserves of the Dominion can be classified as:

1. Forest Reserves in well populated districts.
2. Forest Reserves in rugged and mountainous country or in the practically unsettled and largely unsurveyed country north of the prairies.

Forest reserves in populated districts generally consist of sandy, more or less timbered, and as a rule hilly country surrounded by settled agricultural land. Such reserves are for instance the Moose Mountain, the Elbow, the Cypress Hills, the Manito, the Dundurn, and other forest reserves in the southern or central portions of the settled parts of the prairie provinces.

A survey of such an area approaches a soil survey in as much as it involves a very careful examination of the soil conditions especially in the transition area between the interior non-agricultural and the surrounding agricultural lands. For that reason it is necessary that the officer, to whom the work of examining proposed forest reserves of this character has been entrusted, should have more than the ordinary knowledge of soils. Every quarter-section must be carefully examined and a correct classification of the land by climate, topography and soil into agricultural and non-agricultural land made. Lands that are positively adapted for the continuous production of farm crops or which are chiefly valuable for agriculture should be excluded, while lands that are undoubtedly non-agricultural or lands that possess minor agricultural possibilities but are more valuable for the growing of crops of timber, should be included in the proposed reserve.

Areas unfit for farming in the settled portions of the central provinces are comparatively few, and it is of great importance that all available land of this class be devoted to the growing of timber, thus to relieve to a greater or less degree the need of firewood, fence posts, and small building timber, which is always felt on the treeless prairies.

Proposed forest reserves in unsettled districts do not require such a detailed examination. The reconnaissance in this case is more in the nature of an exploration in contrast to the survey of the proposed reserves in the old settlements, which really, as explained before, takes the form of a more or less intensive soil survey.

Here large areas of unsettled and largely or entirely unsurveyed lands are involved and anything but an extensive reconnaissance is at the present time impracticable and out of the question. This does not mean, however, that care should not be exercised by the forester in determining proposed reserve boundaries. On the contrary, the future possibilities of the land should be considered and the inclusion of agricultural land should wherever it appears in appreciable quantities, be avoided unless its temporary reservation is considered advisable until such time as the present crop of timber thereon has been removed.

A survey of this kind is, of course, only preliminary. Its principal object is to have defined by settled lines any tract of land that is non-agricultural, but is or will become if properly protected of considerable value as forest land.

There may, however, be present within the proposed reserve isolated small areas of soil of agricultural possibilities. To exclude small patches here and there is of course hardly advisable until a more intensive soil survey has been made so as to accurately locate the position and boundaries of any agricultural land. It must also be remembered that the soil is not the only determining factor. The questions of forests, of cost of clearing, and of accessibility must also be taken into consideration. As a result of re-examinations many sections have been eliminated from established or proposed forest reserves.

More extensive areas of agricultural soil which by reason of being heavily timbered are recommended by the forester for reservation should, however, be carefully shown on the map and fully described in the final report so as to make the situation perfectly clear to the Director of Forestry before he is called upon to decide what further action should be taken in the matter.

The officer in charge of a reconnaissance party should always make it a point to acquaint himself with the views held by settlers that live in the vicinity of the proposed reservation, in regard to the establishment of a forest reserve. He should explain to the farmers that the creation of a forest reserve means protection of timber, grazing and water supply for the use of the farmer himself. The idea is here and there prevailing that a forest reserve is created to prevent the "poor man" from getting his supply of firewood and building timber. This opinion, which of course, tends to make the forest reserves unpopular should be corrected.

The following outline for the reconnaissance refers only to surveys in the more unsettled districts; that is, reconnaissance surveys which, while furnishing us with general information in regard to the general characteristics of the region examined, are not expected to be of a detailed or intensive nature.

Schedule for Reconnaissance Survey Reports.

Introductory.

An abridged description of the progress of the survey containing information about:—

Composition of party.

Duties of the various members.

Number of working days, distinguishing between days spent in moving camp, in actual field work, and in camp.

A short description of the manner in which the work was carried on.

Cost of survey.

1. General Description of Lands Examined.

(a) Geographic Situation.

(b) Climate.—Information in regard to length of growing season, prevalence of forest, precipitation, etc.

(c) Geological Formation and Topography.

1. Elevation, average, highest and lowest.
2. Surface form, level, rolling, broken, hilly or mountainous.
3. Drainage.
4. Soil, subsoil and humus. Depth and moisture contents of various soils should be noted, soil moisture being defined as wet, moist, fresh, dry, or very dry.

(d) Forest Growth.

1. Type Classification.
    - (a) Permanent or natural site types based on physical condition of situation.
    - (b) Temporary types caused by external influences.
    - (c) Cover types.
2. Species, according to commercial importance.
3. Silvicultural condition of the timber, information as to insect and fungous attacks.
4. Ground cover and underbrush.

(e) Reproduction.

(f) Fires.—Under this heading should follow a short description of areas burnt over giving as near as possible year of fire, the stage which the reproduction has reached and other information which may be of interest.

(g) Cutover Lands.—Such information as may be of interest in regard to manner of logging and the condition of the logged-over lands after the cutting in regard to brush, remaining stand, and reproduction.

(h) Grazing.—Report on lands which are in their present state suitable for grazing and whether at the present time they are used for that purpose.

(i) Settlers.—If settlers are located on any portion of the land which is included in the proposed reserve, the report should contain information as to location of the homestead or squatter's claim, name of settler, extent and value of improvements, length of residence, what title is held to land, character and quantity of crops being grown and fitness of soil for permanent agriculture.

If any abandoned homesteads are found, enquiries as to the reasons for the abandonment should, if possible, be made.

(j) Fish and Game.

II. Proposed Reservation.

Under this heading should be described by section, township and range, the land which the forester recommends for reservation. The reasons on which the recommendation is based should be given.

III. Fire Protection.

A report on the efficiency of the present fire patrol and suggestions as to its improvement in regard to such matters as ranger district boundaries.

sites for ranger stations, caches, lookout stations, number of ranges and trail and telephone construction.

IV. Growth Studies.

It is not expected that much time should be given to growth studies. Much of this interesting and useful work can be done, however, right around camps or in rainy weather which may prevent the reconnaissance party from doing other work.

V. Approximate Areas.

A statement giving the percentage of area in the proposed reservation covered by lake, muskeg, grazing land, timber, burn, brushland, etc. This statement should, of course, agree with the map and tabulated statement.

Map and Tabulated Statement.

The report should be accompanied by a map on which should be shown:—

Topographic features.
Proposed Reservation Boundaries.
Forest Cover by Cover types according to broad lines.

Each cover type should be given a number on the map and the characteristic stand of each type should be briefly described as to natural type, species, age, average cut per acre, soil, etc. This description should be entered in a tabulated statement of which forms are furnished.

The estimated average cut per acre in each stand is important information inasmuch as it will help us to form an idea of the timber supply of Canada. It is not expected, of course, that the estimate should be anything but approximate.

(Copies of Forest Atlas, Legend "A" and "B" are furnished the forester. It is desired that Legend "B" should be used for types and Legend "A" for conventional signs and tree symbols when making the final map for the Department.)

The numbers of the cover types as shown on the map should be placed in the upper right hand corner of the type. The numbering shall begin in the upper left corner of the map running from there across the map over to the right hand corner, then back to the left side of the map, then back again to the right and so on until every covertype or stand shown on the map has been given a number.

This outline gives a general idea of what subjects the chief of the reconnaissance party has to keep in his mind. With your permission I would now like a say a few words about the more important of these subjects.

Type Classification.

While the reconnaissance officers are not expected to approach this subject in such a scientific manner as is necessary on intensive forest surveys, the general importance of the subject is pointed out to them and they are asked to study to the best of their ability the physical and biological factors that produce the great variety of conditions of forest growth.

We have in forestry the following three type-designations:—

1. Natural or fundamental forest types.
2. Temporary forest types, and
3. Cover types.

The last mentioned designation, "Cover Type" does not take into consideration situation, soil, climatic conditions, etc.; it simply describes the present stand according to species, density, age, etc. For instance, "recent burn", "burn reproduction established", "cut-over land", "brush land", (meaning willows, alder, scrubby poplar) "Woodland cordwood, poles". "2-5 M ft. B. M. per acre", "5-10 M. ft. B.M. per acre", and so on. This classification of "cover" types is used on our reconnaissance maps at present. It is useful inasmuch as it shows at a glance on the map the location and area of the various stands as they are now. It also gives us a fair idea of what is the present amount of fuel, cordwood, and saw-timber, and what percentage of the tract is occupied by brulées or muskeg, on the area examined. Of course, the reconnaissance officer is expected to discuss in his report the various natural and temporary types present but as he, as a rule, has to cover several thousand square miles in one season, he has not much time for any detailed studies of this nature.

Whenever we make an attempt at forest management, however, we must make a study of the natural types. We must reduce the great variety of stands which we find intermixed in the forest to a small number of types, each having characteristic features of its own and requiring distinct treatment. I would like to quote a few sentences from an article "Principles Involved in Determining Forest Types," by Raphael Zon, Chief of the Office of Services, U.S. Forest Service.

"The division of a forest into natural types of growth, is not such a simple thing as it may appear at the first glance. Stands differ from each other in many respects; they may be pure or mixed, even-aged or irregular, dense or open, of seedling or sprout origin, etc. Which of these features justify the subdivision of the forest into types of growth, and what must we call a natural forest type? In order to answer these questions, we must analyse the factors that produce the great variety of conditions of forest growth and determine which of these factors are fundamental and permanent and which are only secondary and temporary. When we attempt to trace to some definite cause the differences between stands composing a large forest we finally come to two main ones; first, external physical conditions, such as climate, soil, moisture in the ground, topography, exposure, etc.; and second, interference by man, and natural accidents, such as fire, wind, and so on. Interference by man and natural accidents to the forest are principally responsible for the secondary, less-important difference in stands, like density, mode of origin, (sprouts or seedlings), age, though they frequently lead to even a temporary change in the composition of the forest. It does not take very long to realize that segregating stands into types based on density, age, or mode of origin can not be justified, since such features are not permanent and cannot be characteristic of any definite forest type. Stands may differ radically from one another in character of growth and, nevertheless, have the same density or the same age, and vice versa; stands of different ages and density may at the same time exhibit the same character of growth. Another thing is the composition of the stands. As a matter of fact, most of our forest types are based on the prevalence of one or another species in the composition. Is composition a safe guide in establishing forest types? We know for instance that after white pine or spruce forests are cut over and burned by fire, aspen, birch, cherry, and other hardwoods take their place. This occupation of the ground, however, is only temporary; eventually, white pine and spruce reappear beneath the hardwoods and crowd them out, thus restoring the original type of growth. Such examples are very numerous. A forester who mistakes temporary forest growth for the original natural types thus failing to understand the natural evolution of the forest, will always have nature against him in all his operations, instead of being aided by her. He will open up the forest with the intention of getting reproduction of the standing hardwoods, and to his surprise he may find spruce or hemlock instead.

By leaving out such temporary changes in the composition of the forest which are traceable to the influence of man or fires, the prevalence of one or another species in the composition cannot be relied upon for making natural forest types even in a virgin forest untouched by man. Who, for instance, would even for a moment, throw together in one type, spruce growing in the swamps, with spruce on the slopes, though its percentage in both situations may be identically the same? The growth of the individual trees, and the development of the whole stand in the two situations, is as radically different as if we had two entirely different species. The influence of man, wind, or fire may bring about a change in the density and other secondary features and, in extreme cases, even a temporary change in the composition of the forest; but if the fundamental physical conditions of growth remain unchanged thereby, the forest will in time return to its original type, conditioned by the external physical factors (just as a stretched string set to vibrating by a stroke of the finger returns sooner or later to its original position, determined by the points at which its ends are fixed). The changes which are brought about in a forest by the interference of man or by accidents cannot, therefore, serve as a basis for the establishment of fundamental forest types. However, since these changes must be reckoned with, often being of such a character as to necessitate a special silvicultural treatment, we may call them **temporary, transitory,** or **derivative** types, in distinction from the fundamental forest types, which are the result of natural factors only.

The physical conditions of the situation then are the main factors which determine the whole character of a forest type. Of these physical factors, climate has undoubtedly a marked influence upon plant life, if we compare vegetation of different latitudes. But soil moisture in the ground, and topography, to which in mountain countries must be added altitude and exposure, are the main factors which determine the character of forest growths in a forest region, and therefore, must be accepted as the basis for the division of the forest into natural types of growth. A natural forest type, then, is an aggregation of stands which may differ from each other in age, density, and other secondary features, but have the same physical conditions of situation, soil, topography, exposure, etc.

If the subdivision of a forest into types of growth must be based not so much on the features of the stands as on the similarity in the external physical conditions of their situation, the first step in establishing forest types in any region is to divide the forest area according to its salient topographical features, like river bottoms, slopes, and ridges, and then to further subdivide it within a uniform topography, according to soil, moisture in the ground, exposure, etc."

In the country north of the Prairies we would ,for instance, recognize the following important natural type sites:—

Spruce Flat Type.

This includes the level or slightly rolling well-drained flats along rivers and streams, and around lakes. Here we generally find the deepest, richest soils, on which spruce thrives very well and reaches its best development. However, due to fires, many of these flats are now covered with the less desirable poplar species.

Spruce Slope Type.

The gentle slopes where the soil is somewhat shallower and often more or less stony. Spruce is here, except in hollows, often, while quite tall of smaller diameter than on the spruce flats. Unfortunately aspen and birch are as a rule numerically superior at present.

Sand Flat Type.

Sand plains where Jack-Pine, in the east and lodgepole pine, in the west, appear in pure or almost pure stands.

Sand Ridge Type.

Sandy ridges in muskegs covered with jack pine of often scrubby growth. Sometimes aspen and spruce have encroached on the sandy sites.

Summit Plateau Type.

In Northwestern Alberta, covered with lodgepole pine sometimes in admixture with black spruce.

Muskeg Type.

Occupied by black spruce and tamarack.

There is no doubt that pure spruce represents the climax type on the spruce flats and spruce slopes. Remnants of fine pure spruce stands are still to be found, but aspen is, numerically, by far the leading tree. In many places repeated forest fires have gradually killed all spruce resulting in pure stands of aspen. Luckily, however, reproduction of spruce under aspen is present on larger areas and with an efficient fire protection, we may hope that spruce will in time get into its own again.

As to soils it may be said in general that much of the soils in the wooded districts of the northern portions of the Prairie Provinces are unsuitable for agriculture. The most common types of soil are the pure sand and the boulder clay. The pure sand soil is of course always non-agricultural. As to the boulder clays it is the percentage of space occupied by the boulders which to a large extent increases or decreases the value of the soil for agriculture. The lacustrine deposits of clays and loams may often be classed as agricultural but these soils are generally poorly drained and covered with large muskegs. I am of the opinion, however, that an efficient system of drainage would convert many of the numerous muskegs into land of a high silvicultural and agricultural value. I understand that the Reclamation Service has under their supervision several projects of this nature. Many hay-meadows and sloughs are too low and wet at present to make them available for grazing. Draining would here do much good. Often the rough nature of the topography makes tillage impossible or difficult.

Timber Estimate.

The report of the reconnaissance officer should be accompanied by an approximate estimate of the average cut per acre in cord or board feet of each species in each cover type covered with forest growth large enough to estimate. For instance, in regard to more recent brulées he should state what percentage of the area is covered with reproduction and of what species also giving the percentages; in regard to cordwood, poles, etc., he should estimate how many cords of spruce, of poplar, of jack pine, etc., are available per acre. If the forester meets with any stands of saw-material he should judge the average cut per acre in board feet. It is obvious that the estimates can only be approximate. The reconnaissance officer has not the time to do any regular cruising. Using survey lines, trails, or watercourses, as baselines he runs the compass lines into the surrounding country, mapping the boundaries of the various stands as he meets them and estimating the cut to the best of his ability. He cannot run his compass strips at very close intervals but by taking advantage of high knolls or tall trees, he is often able to connect his stand or type boundaries in a satisfactory manner. Should he not be accustomed to occular timber estimating. he may select, as he goes along, sample areas, half an acre or thereabouts in size on which he counts all trees by species and diameter classes. From existing volume tables he can later get a fair idea of the number of cords or board feet on the plots, representing the average of the stand, which he has selected. We must remember, however, that the area allotted to each party for a season's work is very large and that, unless the officer has a constant tendency to either under or over estimate, the inaccuracies may to a large extent cancel each other.

We have examined in Manitoba altogether 46272 square miles. This area covers the country from the settled districts northwards to about township 58, east of Lake Winnipeg, and to Township 51. west of said lake and Lake Winnipegosis. It also includes the country adjacent to the Hudson's Bay Railway, and the Riding Mountain, Duck Mountain, and Porcupine No. 1 Forest Reserves. In the following estimate, these reserves and the country along the H. B. Ry. are not included. The area to which the figures, I now give, refer is therefore 30340 square miles.

Of this 24% is timbered (posts, poles. included);
36% recent burn or covered with young reproduction;
35% muskeg;
5% grassland, water or cultivated.

Of the timber, approximately 25,000,000 cords, about 30% is Poplar, 29% jack pine, 25% spruce, and the remaining 16% is tamarack. birch, and poplar.

In Saskatchewan the total area examined is 27,504 square miles, covering a tract reaching from the settled district northwards to about Township 66. If we deduct the area of the forest reserves, with the exception of the Big River Reserve, we have an area of about 20,000 square miles. covering the country around Big River, Beaver River, Waterhen lake, Dore lake, Montreal Lake, Candle lake, and Amisk lake. Of this:—

41% is timbered;
18% is burn;
33% is muskeg, and
8% is grassland. water, etc.

The amount of timber per square mile is here greater than in Manitoba, no doubt due to that a lesser area has been burned over in recent years. The total number of cords available is estimated to between 40 and 50 million cords. Of this about 75% is aspen and poplar, 13% spruce, 10% jack pine, and 2% tamarack, birch, and balsam.

This may now be changed to some extent due to the large fires in Saskatchewan last year.

In Alberta, we have examined 63,000 square miles covering the Rocky Mountain Forest Reserve, the Grand Prairie and Clear Hills district. the Peace River Block, the country between the Athabaska river and Lesser Slave lake, the Pembina mountain, Lac la Biche, Christina lake, and Cold lake Districts. Leaving out the Rocky Mountain Forest Reserve, this area occupies 41371 square miles of which

48% is timbered;
32% burn;
5% muskeg;
15% prairie.

The timber amounts to some 100 million cords of which 40% is poplar. 30% spruce, 25% jack pine, and lodgepole pine, and 5% tamarack, balsam fir, and birch.

From the above it follows that at present aspen is the predominating species in the district north of the prairies in the Middle West. Spruce, which of course is commercially the more important species, lags considerably behind. The only practical way of reversing the situation is to keep the fires out until the forest has returned to the original type and wait for many years, except perhaps on limited areas on forest reserves where through a judicious system of cutting or through planting, reproduction of spruce may be established at an earlier date.

I am afraid, I have been speaking at too great a length on the reconnaissance work carried on by the Forestry Branch. It may not be of much interest to the members of this Association. I am glad, however, to have had this opportunity to speak to you about this phase of the forester's work.

Before I close I would like to say a few words about the more intensive forest surveys which are carried on in established forest reserves.

An intensive forest survey embraces the gathering and tabulation of all data in regard to forest lands including plane and topographic surveying; determination and description of soil and forest types; timber estimates; forest description; grazing data; construction of volume, growth and yield tables; studies of the silvicultural conditions and the factors affecting logging, and the preparation of maps showing topography, forest types, soils and age classes.

The object of intensive forest surveys is to secure data on which to base working plans or timber sales. Such a survey has just been completed of the Petawawa Military Reserve, a certain portion of which (about 100 square miles) has been set aside as a forest experiment station of the Dominion Forestry Branch.

A system of base lines and controls was first established. The base lines were run two miles apart, and posts were placed at every 10 chains. The field work was thereafter done by what is known as the strip system. The principle of this method is to cover the area under examination with narrow parallel strips distributed at equal distance over the whole tract and covering a specified percentage of the area. The strips may then be taken as samples representing the whole area. The strips are generally one chain in width. Thus a strip 10 chains long constitutes one acre. The distance between the strips depends on the character of the topography, the timber, and the accuracy required. Ordinarily 20 chains between strips, or a 5% estimate, is considered sufficient. In general, it may be said that the larger the area to be cruised is, the smaller can the percentage be and yet a good result can be secured. At Petawawa, the strips were as a rule run 20 chains apart. The distance was never greater but was sometimes reduced to 10 chains.

The trees on the strips were calipered and tallied on special tally sheets. A separate sheet was used for each sample acre, that is for each 10 chains, but in addition the sheet was changed whenever the strip crossed the boundary of a stand the character of which (in regard to type, species, age, density, etc.) differs materially from the preceding stand. Boundaries of stands, as well as all topographical features, were plotted on the map sheet for which cross section papers is used. Each stand is given a certain number on the map, on the tally sheet, and on the descriptional card which is made out for each stand. This description should contain information about forest type, site class (which is a designation of the relative productive capacity or quality of different sites with reference to the species concerned, the height produced at a given age generally being used as standard for classification); soil, species in percentage, density, age class, height class, silvicultural condition of timber, reproduction in percentage of species, ground cover, growth percent, proposed silvicultural treatment, etc. Heights are measured with an hypsometer of some kind, diameters are measured with calipers, growth percent is studied with the help of an increment borer. The strips are run with a staff compass and distances are measured with a chain tape. The mapping party at Petawawa consisted of one man mapping and taking notes, one man running the compass, two men calipering and chaining, one man tallying and checking the caliper men.

In this way the whole reserve was covered with parallel strips 10 to 20 chains apart and one chain in width. Each stand was mapped and fully described. Based on these data, type, soil, and age class maps are now being prepared. Tabulated statements giving particulars of each stand, quantity of timber according to diameter classes; and species, distribution of age classes; summary of estimates; etc. and a final report containing a general description of the reserve in regard to topography, geologic formation, soils, drainage, climate, forest types, silvical characteristics of the important species, underbrush, ground cover, physical and biological injuries, market and transportation facilities, growth and yield, proposed system of silvicultural managements for the different types, proposed improvements for administrative purposes, etc., in short, everything that will or might be of influence in the future continuous management of the reserve.

As I mentioned above, the Petawawa Reserve is also a Forest Experiment Station, where silvical and silvicultural investigations on permanent sample plots were begun two years ago.

On this tract are found practically all important species characteristic of a large portion of Ontario and Quebec. They are present in pure as well as mixed stands from the seedling stage to, in some cases, maturity. Many areas are especially well suited for experiments in thinnings and other intermediate cuttings; large "burns" and abandoned farms await the forester's aid to establish reproduction by artificial means; on other tracts different silvicultural systems may be tried and compared as to their results especially in regard to reproduction; certain areas are suitable for forest conversion experiments; etc. Other important investigations which have been or should be commenced as the work develops relate to natural reproduction and its development on old "burns" and cut-over lands and to the solid conditions necessary for natural reproduction; yield of fully stocked stands of certain species at different ages and on various sites; study of the variations in bole form and bark thickness of forest trees and new methods of preparing taper and volume tables; the mutual relation of soil, ground-flora and the stand; insect attacks, their limitation or prevention; study of seed especially with reference to its origin; study of the adaptability of foreign tree species to Canadian conditions; and many other problems of general or special interest.

As I began with the quotation of a bit of ringing verse by one of your own members, so in ending, I will, with a very slight alteration, quote from Robert Service's "Men of the High North" a stanza which I think embodies the spirit of land surveyors and foresters alike:

> "Men of the wilderness, fierce mountains love you;
> Proud rivers leap when you ride on their breast.
> See, the austere sky, pensive above you,
> Dons all her jewels to smile on your rest.
> Children of Freedom, scornful of frontiers,
> We who are weaklings honour your worth.
> Lords of the wilderness, Princes of Pioneers,
> Let's have a rouse that will ring round the earth."

THE CHAIRMAN: Mr. Wallin has devoted considerable time to the preparation of this interesting paper. Is there any discussion ?

MR. NELLES: This is one of the most interesting papers that we have heard; it is also one of the most important. Legislation regulating the forest operations should be passed as soon as possible. The men sent by Canada to England and France in 1916 and 1917 to cut timber for the operations of the army received an education that could not be duplicated in twenty years of educational propaganda in Canada. They soon came to know what the care of forests meant. The operations in France embraced the cutting of pine and oak. Pine is cut clear; there is nothing left. The stumps are cut close to the ground; the bark is taken off the stumps and the whole thing is replanted. Operations in oak are conducted differently; certain trees are cut down and others left standing for re-seeding.

To show what forestation means, I may point out that in the Beausejour mountain district near the Swiss border, the communes own their own forests. They conduct the operations themselves; they take out firewood timber each year and sell it to themselves and the price they receive pays all their taxes and gives them a dividend.

MR. BLANCHET : The question was brought up whether the figure seventy-five per cent as applied to the amount of aspen in the portion of northern Saskatchewan referred to is too high. I do not think it is. You see the remains of probably the best spruce forests in any part of the northern prairie country up through that district; they have all been burned over.

MR. CLAUGHTON-WALLIN: There is no doubt that in a few years, if these areas are left alone, there will be great spruce forests there.

MR. SEIBERT: Has Mr. Wallin any statistics as to how much of that country is still covered by original forests ?

MR. CLAUGHTON - WALLIN : I would say that not five per cent. is virgin forest, except possibly in muskeg swamps, and so on, and perhaps around the lakes.

THE CHAIRMAN : I do not want to cut off the discussion of this valuable paper, but our luncheon is at 12.45 and there is another paper on the programme for this morning. Mr. W. E. Morgan, of the Topographical Surveys Branch will now give us a paper entitled "Suggestions in Field Photography".

FIELD PHOTOGRAPHY

MR. MORGAN: When I was asked to give this little talk on photography, I must confess that I did not know how to go about it. I spent a number of perfectly good noon hours writing a lot about its history, starting as far back as 1839, at the time of the discovery of the daguerrotype by a French gentleman and touching lightly on such points as the first use of hyposulphite of soda for fixing; the blueprint process bath by John Herschell, the discovery of gun cotton in 1846, and the gathering together of the various discoveries by Frederick Scott Archer in 1851 in the wet plate process. Up to this point, 1851, I found that I had written about half an hour's talk and that I had still a long distance to go before getting down to the present time; so I scrapped all that I had written and fell back upon some suggestions given me by Mr. Blanchet. He suggested that I deal with the camera only. I started out to describe different types of camera, and I found that there was no end to the subject; so I confine my remarks to the one type.

PHOTOGRAPHY FOR SURVEYORS

—BY—

W. E. MORGAN, ESQ.

The Camera to Use.

It is my opinion that the folding type of hand camera, using roll film and taking a picture of medium size, say 2¼ x 3¼ or 3¼ x 5½ is the best for field use. It is very portable and can be made ready for action quickly. It can be loaded and unloaded in daylight and the films can be developed without the use of a dark-room.. This is not possible with cut films or plates.

The Lens.

The camera should be equipped with a good anastigmat lens, for while I believe that in the majority of cases, the rectilinear will do just as good work, there are times when, working in a poor light, you have to make a quick exposure or where speed and definition are required that the anastigmat has the advantage.

Tripod.

A tripod should always be carried, a good substantial one, with a long extension so that the camera can be set as high as possible.

Shutter:

The lens should be fitted with a shutter giving a good range of speeds. The best makes usually range from 1/200 of a second to 2 seconds.

Diaphragms:

An indispensable part of all between—lens shutters is the diaphragm or stop, which is usually an opening which can be regulated from outside the lens barrel, making the opening larger or smaller in proportion to the sharpness of definition required on the plate. The smaller the aperture the greater will be the depth of focus of the lens and the longer the exposure.

Depth of Focus.

By depth of focus is meant the power which a lens has of rendering sharp images of objects situated at varying distances. When using a lens at full opening, it is difficult to obtain at one and the same time a clear and sharp image of both near and distant objects. To obtain this increased sharpness you must make use of the stop or diaphragm. The diaphragm markings are usually arranged at the lower front part of the shutter. For snap-shot work use the larger opening, in average view work it is seldom necessary to stop down smaller than F. 8 or 11, or their equivalents U.S. 4 or 8. The smallest opening should only be used when extreme sharpness of the whole field is desired, for example, when photographing an interior, it will be necessary, to secure detail and to have objects close to the camera, in the middle distance and in the distance equally sharp. The two systems of numbering stops most in use are the F. & U.S. or uniform system. The F system refers to the relation of aperture diameter to Focal length of lens; while the U.S. is a uniform series of markings based on the same principle. These are their corresponding values:

U.S.	1	2	4	8	16	32	64	128	256
F.	4	5.6	8	11.3	16	22.6	32	45	64

The exposure with a certain stop is ½ of the next smaller and double that of the next larger. If F. 8 requires an exposure of 1 second the next smaller will require 2 seconds while F. 5.6, the next larger, will need ½ second. In the U.S. or uniform system, which is the one used on the most American make of cameras, No. 4 requires 1 second, No. 8 will need 2 seconds and No. 2 ½ second. The largest working aperture of the lens on the average hand camera is F.8 or U.S. 4. Remember large numbers indicate small openings and the smaller the opening the longer will be the exposure.

Focusing.

Focusing means the act of bringing the image into focus: namely the securing of a sharp outline of the image upon the sensitized plate or film.

Fixed Focus.

Is the term applied to small cameras with short-focus lenses which are fixed in one position. With the short focus lens the difference in focus of any object, far or near, is so small that it is not noticeable in a small picture. When a camera is extended and the indicator points at 100 feet, we speak of setting it at universal focus or infinity, all objects beyond 100 feet being in focus.

Scale Focusing.

The hand camera is furnished with a scale usually marked 6-10-15-25-50-100 feet. The figures indicate the distance in feet the camera should be placed from the object to be photographed. It is safe when distances are over 50 feet to set the pointer at 100 feet. When the object photographed is near the camera great care should be taken in getting the distance right, measure it or step it off.

Finders.

Hand cameras are fitted with finders, but I think there should be some other device for finding the view. In the average finder, I know I have difficulty in locating it. I would prefer a direct view-finder or a wire frame such as is fitted to some cameras of British make; with either of these. you see the view from the level of the eye and do not have to hold the camera low down, and bend over it; besides it is easier to locate the view in the direct view-finder.

Exposure Meters.

There are a number of instruments that are designed to measure the intensity of the light and thus arrive at the correct exposure. Some depend on the darkening of sensitive paper to a fixed tint, and one I know of, called the Trilux, on the disappearance of a star, or cross, fixed at the end of a tube, with an opening at the side which can be gradually closed, shutting off the light till the star disappears. You can then read the exposure which is figured for F.16. A friend of mine who used this instrument had good success as long as he followed its readings. There are also exposure tables arranged in various convenient forms, and I believe the latter are as reliable a guide as any. I would suggest that the Wellcombe photographic exposure record and Diary published by the Burroughs Wellcombe Co. of London, Eng., be supplied to all those who are to use a camera. It contains an exposure calculator and tables of light values, and a lot of other useful information. Of course, it advocates the use of tabloid preparations, made by this firm, some of which I have tried and found them very good.

Getting Camera Ready for the Season.

The first thing is to see that your camera is in order. Take off the back and wipe out the dust from inside of the bellows; do this thoroughly, using soft cotton, just damp with water or oil. This treatment is almost a sure cure for pinholes, for if there is dust in the camera, every time you pull out the bellows the dust is stirred up and settles on the film, preventing the light from acting, and resulting in the clear specks called pinholes. Be sure the lens is clean. but be careful how you clean it. Use soft old linen rags and wipe lightly with a circular motion; in case of finger-marks, breathe on lens. See that your shutter is working right at all the different speeds, you can judge this better with the camera back off, looking through the lens while working the shutter. Examine the bellows for holes, for no matter how small, light will get in and fog the film.

Loading and Unloading.

In loading the film into camera see that the empty spool is properly put in, with the winding key well seated in the slot, put the roll in the other side without breaking the seal, then break the seal and bring the end of the paper over to the winding spool entering it in the slit so it will run true, if entered to one side, it will crowd over, break the edge of the film and probably jam. If you try to force the winding you are liable to break the winding key. After exposure do not continue winding till the film slips off the spool, leave a turn or two on till you take off the back, you can then keep a tension on the film, while finishing the winding, thus preventing the film from loosening up. This should be watched carefully both in loading and unloading, for if it does loosen the light will get in and fog the edges. We have developed many that were spoiled in this manner and also a good many that were spoiled by the film not running true, or as I said before, crowding over to one side. It is a good plan to form the habit of turning the film to the next number immediately after making an exposure. You are then always ready on short notice to make another exposure ; also in case of a known accidental exposure there is only the blank film to spoil. It is well also to keep your shutter set for instantaneous use and your diaphragm at full opening, always putting them back to this state if it has been necessary to change them. After film has been exposed and wound up, seal and number the roll. It is well to develop as soon as possible after the roll is filled.

Developing.

When developing with a tank it is best to follow the instructions which accompany it. The developer can now be had, put up in glass tubes, which is an improvement over the paper packages. In dissolving crush any lumps which may be found in the sodas and stir the water while slowly adding the chemicals, being sure everything is dissolved. In summer do not have the water warmer than 65 degrees. Cool by setting the tank in spring or well water, or if none is handy, wait till you can get to a supply. The fixing bath should also be kept cool. Films should be fixed thoroughly and evenly. This can be only done by keeping them on the move while fixing. If handled in this manner the films should be fixed in 15 minutes, and should then be well washed. Anchor the film in a running stream if possible, or wash with frequent changes of water for one hour. In any event fix and wash well as this is important if the negative requires subsequent treatment. If after proper development, your negatives are thin with no detail in the shadows, you are undertiming, if thin but full of detail, they are probably overtimed or fully timed but taken in a poor light. The success of a picture depends on the lighting; do not make a picture on a dull day if you can possibly help it. If you are photographing a road and want to show it at its worst, have the sun to one side and low, so as to throw the ruts and other imperfections into relief. You can make the same road look almost like a good one by having the sun over head or at your back and giving a full exposure. In copying an inscription in raised letters on stone, make the exposure when light is in such a position as to make the letters stand out. The same applies when photographing a house, make the picture when the sun is at the right angle to give the best effects of light and shadows. Never make these exposures in a poor light. There is wide difference of exposure when making a picture in the open and when making it in the bush. Using the same stop in either case, in the open it might be 1/25 of a second, while in the bush 1 or 2 seconds might not be too much. Besides in the bush, as all objects will be near the camera, you would have to stop down in order to get sharpness, much the same as when making an interior, and a further increase of exposure will be required on this account.

The Subject.

For close-ups to give detail in rock formation, plants, or any small objects which you would like to show up to advantage, a portrait attachment would be of value. This is a supplementary lens which fits over the front of the camera lens, and must be used according to directions for the No. 1 to No. 3 Kodaks to work at 2′8″ from the object. You would set your camera focus at 6′; to work at 3′ set camera focus at 10′; to work at 4′ set camera focus at 25′. In photographing groups use the camera on a tripod, as a group should not as a rule be taken in the bright sun. The exposure will therefore be longer and if you are not holding the camera, you can devote your attention to making the exposure, watching the group and exposing when all are at their best. The exception to the above is when those who compose the group are very much sunburned and dressed in dark clothes. It is better then to make the exposure in the sunlight. In photographing to bring out any special object, you would naturally have it in a prominent position and yet in keeping with the rest of the picture. Focus on the object and have it a little better defined than the rest of the picture. To show the general lay out of the country, the picture should be taken from an elevation looking down on the view. I know this is not always possible, but get your camera as high as you can. As to the point of view it is a good deal a matter of taste and sometimes you have not much choice, but as a rule it is best not to have the picture balanced on both sides with objects of equal importance. Almost any view is better taken at an angle, with principal objects more to one side and to the front running off to less important objects on the other side. It is a good plan to go over the pictures you have taken and see what you could have left out. In some cases you will see that you could have made two good pictures out of one not so good. Use a couple of pieces of card cut in the form of a carpenter's square to block out unnecessary parts.

Snow Pictures.

In making snow pictures the principal secret is in the proper exposure and angle of light. Early in the forenoon before nine o'clock or after two in the afternoon will give good lighting. The best results are obtained in the morning early when the shadows are long. Snow pictures can only be successfully made in bright sunlight as you must have high lights and shadows even in white snow. On account of the reflection from the snow the exposure should be about half what you would give if there were no snow. Always have the angle of sunlight towards the object and from one side, if in this direction the object will be strongly illuminated by reflection. If it should be towards the camera, then the plate through the lens will receive the flood of reflected light, causing fog and spoiling your picture. Have the foreground broken up with some dark objects, anything which will supply shadows or dark spots; a few tracks on a level expanse of snow will add greatly to the effect. Your lens may scum over on cold days when first taken out but will clear up in a short time. To develop snow scenes use ordinary developing formula. See that the temperature is 65 and develop a little longer than usual.

Points to be Recorded.

Points in connection with the exposure to be recorded and which are well explained in the "Welcombe Diary" are:—Date, No. of Slide or Roll, Make of Plate or Film, Time of Day, Light, Stop, Exposure, Notes on Subject, Lighting, etc., No. of Negative. These when compared with results will enable you to correct mistakes in future exposures. As for the Autographic record, I do not think much of it. There is not room for a complete record and I have never been able to read anything that was recorded. No doubt this is due to faulty manipulation, but, nevertheless, I believe it is just an additional complication of doubtful merit.

Suggestions.

I would suggest that all who are going to use cameras next season be supplied with them now, together with films, so that they can get out and make pictures, have them come into the office and have them developed by tray development, so that they can see just what happens when a film is developed—tray development should be understood before developing in tanks. We will be pleased to show them all we can, and after all you can learn more in a little practice work of this kind than you can in any other manner. I think it would be a good plan to mount a print from each of your negatives in a small book that could be carried with you. Put them in, in the order in which they were taken and write under each one all information concerning it, exposure, stop and light, etc. Then when you run up against the same proposition next season, turn back to about the same date in your book and see what your results were and try to improve on them.

While it is out of the question for all to carry large cameras, I would like to load one on Mr. Narraway, who I believe covers most of the ground in the work of inspection, etc. I would like him to take a No. 8 Circuit Panoramic outfit. With this pictures 8″ wide and any length up to 8′ can be made, and with the Panoramic film attachment removed you have a camera taking a 6½″ x 8½ ″ picture. In Mr. Narraway's capable hands we could expect some splendid results.

Camera complete about $200; Film 4 feet, $1.30; 8 feet, $2·60; 12 feet, $2.90.

I would like to compliment those who had cameras last season. There is a great improvement in their work. I have often wondered why men like surveyors used to handling instruments did not make better pictures in the past. I believe now the trouble was that they did not take the photographic end of the work as seriously as they are now doing with such increasing success.

In concluding, Mr. Morgan said:

I have here a few comments upon some of the photographs that were taken during the last year.

Mr. Narraway sent in forty or fifty negatives, all of which were very good, some of them specially so. The first lot that he turned in were better than the last lot.

Mr. Bennett in August last turned in a roll of six. The selection of view was not too bad, but the negatives were not quite sharp.

Mr. Blanchet turned in forty-five at one time, fifty-three at another. About half of them were very good.

Mr. McElhanney turned in about nineteen. Good judgment was shown in selection, but the pictures were mostly out of focus. A camera used out of order would account for this.

Mr. Herriot turned in twelve. The first roll of six were probably the best turned into the office during the year. The camera was a 4A. On the second roll, however, he fell down. Two of the negatives were very good, but the rest were out of focus. In one the camera moved.

Mr. Boulton had a 3A camera. He turned in about eleven negatives, mostly undertimed or taken in poor light. The focus was all right.

Mr. Norrish turned in 120, all very good; foreground out of focus in some cases. Might have been stopped down and given longer time.

Mr. Fawcett turned in sixteen at one time that were very good out of twenty-three. These were taken with a 4A. Then he turned in sixty-two taken with a vest pocket Kodak. Half of these were very good. The negatives were rather thin; I think more development would have been better, or perhaps more time in some cases.

Mr. Lonergan in June turned in some pictures of a spring burning experiment. They were all very good. He evidently knew what he wanted and used good judgment in getting it. In December he turned in twenty more, most of them very good.

Mr. Brenot turned in six vest-pocket Kodak pictures, all very good. Less sky would have been better, but I suppose it is not possible in all cases to get the elevation. In October he turned in fifteen, all very good. Twelve others sent in later were inclined to be thin. As the season advances and the light gets weaker, the exposure should be increased

Mr. Akins sent in eleven in July taken with a 4A. Some very good; in others the foreground was out of focus. Stop down and give more time. In August he sent in eight 4A, all very good. In September he turned in some more. One roll would have been exceptionally good had the negatives not been spoiled in development; they were covered with black specks for which I could not account. The rest of his negatives were good.

Mr. Jackson turned in one roll of six, two of which were good, the rest out of focus. Yesterday about fifty came in; all were very good. I have not yet had time to print them.

To anyone who wishes to read up this subject the following books will be of interest:

Complete Self-Instructing Library of Practical Photography, in ten volumes. Published by the American School of Art and Photography, Scranton, Pa., U.S.A.
The British Journal of Photography.
Photographic Almanac.
American Photography.
Photo Era.
The Camera.
Eastman Booklets.

THE CHAIRMAN: Mr. Morgan's paper has been a valuable and practical one. The subject is now open for discussion.

MR. HERRIOT: I appreciate Mr. Morgan's remarks about those films of mine. Of course, if he had omitted that last comment on my pictures his report would have been more favourable to me. However, a little criticism does no harm. We have listened this morning to three very interesting addresses—it is hard to say which one was the most interesting. Mr. Nelles, Mr. Wallin and Mr. Morgan no doubt gave a good deal of time to the preparation of these papers and I think that we as an Association owe them a hearty vote of thanks. (Applause).

THE CHAIRMAN: Well, gentlemen, the meeting has expressed its thanks for the very excellent papers which you have given us and for the trouble you have taken in their preparation. I am sure that they have been interesting and instructive to all. We will now adjourn for luncheon at the Chateau Laurier.

LUNCHEON AT THE CHATEAU LAURIER.

The members of the Association and a number of distinguished guests met at luncheon at the Chateau Laurier at 12.45 p.m. The President, Mr. Akins, presided, and on his right hand was Hon. Arthur Meighen, Minister of the Interior, and on his left hand Hon. Dr. Roche, formerly Minister of the Interior, now Chairman of the Civil Service Commission, and Mr. C. A. Magrath.

At the request of the President, the Secretary, Mr. F. D. Henderson, presented regrets at their inability to attend from Mr. J. S. Dennis, Mr. W. J. Black and Hon. Senator Casgrain.

MR. AKINS: Gentlemen, the world to-day seems to have placed an embargo on university and technical training. This is well exemplified by something that took place in one of our industrial factories. A man applied for a job in the factory. "Well," said the boss, "for this job we need a man who can speak Spanish, French and Italian. The wages are twelve dollars a week". "Oh well," said the applicant, "I haint got no education; I want a job in the yard". "In that case", said the boss, "see the yardman; he will give you a job at forty dollars a week." However, there is no danger of our Minister, himself a professional man, holding that view toward technical and professional men. We are fortunate in having him with us to-day; he has always attended our annual luncheon and will, I am sure, continue to do so as long as he remains Minister of the Interior. We nearly lost him as our Minister a short time ago; and in one way we are glad that Sir Robert Borden was able to retain his post and not give occasion for Mr. Meighen's leaving our Department. I now have much pleasure in calling upon Mr. Meighen to address us.

HON. MR. MEIGHEN: Mr. President and Gentlemen: This is one of the very many occasions upon which I have nothing of substance to say; I will try to make it one of the few occasions when I really stop at the close. I am very glad that associated with me here is the head of the Civil Service Commission, your late highly-respected Minister of the Interior; I commend to his sympathetic consideration the words of the President in introducing me. From comments that I have heard of late months on the question of remuneration of professional men, I am disposed to think that possibly he holds the view of a Methodist pastor out in my own country who lived for many years on a salary of four hundred dollars. The congregation, in the generosity of their hearts, finally decided to offer him six; whereupon he declined, saying that he had enough trouble trying to collect the four.

As regards the work of the Department, and speaking chiefly of that in which you are interested—the men of your profession are associated with almost every branch of the Department of the Interior—I have been anxious so to organize the service that the country will get the most value from the expenditure and, at the same time, that those in the service will get the most satisfaction from their work. The Dominion Land Surveyors, so far as the Federal Government is concerned, are distributed over quite a number of departments; and in my own there are quite a number of branches. One cannot lose sight of two considerations: First, that, just as in law and in medicine, there are distinct lines of professional activity in the field of land surveying; second, that the purposes of survey work differ in various branches of the Government service. Nevertheless, it is borne in upon me that we are, perhaps, not co-ordinated as we ought to be, and that efficiency might be advanced by a study of the distribution of survey work not only through the different departments, but through Government services other than our own. I do not share the extreme view that there is, at least to any serious extent, what might be called absolute duplication; what may appear on the surface to be duplication may not so appear upon closer and more enlightened examination. Nevertheless, it seems to me that better results could be obtained if we moved more in the direction of unification; if our organization for the purpose became more one than many. There would necessarily be branches; but greater economy and efficiency might result if we should become more unified than we are to-day.

I have nothing more to say on this occasion save to express a word of welcome to the many who are back in the services and in the practice of their profession after the struggle of the war. I believe that no class of men volunteered in larger profusion and with better results for their country than did the engineers of Canada and the members of your own profession. All, I think, have now returned, and to all goes out the warm hand of gratitude and welcome. Last night you had the honour of hearing from the man who had led the Canadian forces, on a subject of which he could speak with greater authority and greater interest than anyone else. I was sorry that it was not possible for me to be present and to hear that address; I had to speak elsewhere, otherwise I should have made it a point of attending. I should indeed have liked to hear General Currie. I shall never forget that in a dark day in June, 1918, when the German forces had stampeded the Fifth Army of Britain, had overrun almost the entire area of northern Italy and had driven the French nearly to the gates of Paris, Sir Arthur Currie was called to London, and in the first and only speech that I ever heard him make he uttered words of encouragement, cheer, and supreme confidence—words that made the whole outlook appear different to me. It is an honour to Canada that we had him as the leader of our forces. Whatever criticism of a more or less fleeting character may be made, the organization of the Canadian forces under him, and in large measure, due to him, was undoubtedly creditable to this country. I thank you.

THE CHAIRMAN: We have with us also Dr. Roche, our former Minister, and now head of that Commission which is of vital interest to us. We will now hear from Dr. Roche.

HON. DR. ROCHE: Mr. Chairman and Gentlemen: For some years now I have had the honour of being an invited guest at your luncheon in connection with your Annual Convention. One feature of your gatherings that is impressing itself more forcibly upon me each succeeding year is that they seem to be getting closer and closer together all the time. Speaking for myself, and possibly for those who like myself are observing their hair assume its final hue—which may or may not be symbolic of the white flower of the blameless life—I am impressed by the fact that twelve months nowa-days seems little more than half as long as that time seemed comparatively few years ago. I assure you that that rapid flight of time is by no means attributable to the pleasurable nature of the vocation in which I am at present engaged. In spite of the harassing nature of the duties of a not-to-be-envied position, time flies most rapidly, I assure you, and will not be halted.

The Chairman has referred to the salaries of those engaged in technical occupations, such as civil engineers and members of your Association. He has commended that matter to the consideration of the Minister, and the Minister has kindly commended it to me as Chairman of the Civil Service Commission. It rather recalls to my mind a song that might appropriately have been rendered by your quartette to-day—a humourous song which I heard sung at the banquet of the Civil Service Association last year, and which was received with great gusto by the civil servants. I refer to a song entitled "Pass the Buck". Next to knocking, that is now the most fashionable occupation that people are engaged in. Still, I exonerate the Minister from any suggestion of doing that to-day, because he was quite within his rights, quite within the law.

The difficulty is, of course, to be able to please every person. As you know, the Civil Service Commission is engaged in the herculean task of endeavouring to fix appropriate salaries to duties of office. While they undoubtedly may make errors of judgment, the desire is to make the salaries commensurate with the importance of the duties. I understand from the press that representations are to be made by your Association to the Government or to the Commission on this subject. While I am not in a position to pledge myself to any particular line of salaries, I assure you that any representations coming from so important a body will be given, in the words of our rulers, "the very best consideration."

During the war our country was passing through its great testing time. But that testing time did not cease with the cessation of hostilities. Since the signing of the armistice many problems of great magnitude and importance have been engaging the attention of the Canadian people. These have tested the statesmanship and tried the patience of our rulers and of our people; but the manner in which they have been resolutely faced and successfully solved make Canadians feel that they have no reason to be ashamed. Compare the position of Canada to-day with that of the war-torn countries of Europe. Canada's position is a most enviable one. Uncertainty, distrust, unrest, social and commercial upheavals, agitation and actual want have prevailed in most of the countries of the world. While Canada has not been entirely free from some of these disturbances as the result of the demobilization and restoration to civil life of upwards of 400,000 soldiers, I think it can be said that on the whole this has been accomplished with a minimum of disturbance if not with an actual maximum of efficiency. Still, there is much to be done; the end is not yet. The war has left us many legacies, many burdens, financial and otherwise, which must be met. But we have every confidence in the ability and the capacity of the Canadian people to solve these difficulties as successfully in the future as has been the case in the past.

I have said that knocking seems to be the most fashionable occupation at present. The fighting spirit has by no means died away. Governments have been toppling over in almost every country; the sentiment seems to be infectious. It respects not international boundaries; it has invaded our own peaceful Canada. Everything that goes amiss is blamed on the Government of the day, from the high cost of living to the small quantity of supplies on hand for irrigation purposes. They are condemned by the drys; they are condemned still more by the wets. Ninety per cent of the beneficial legislation that is placed on our statute books is lost sight of and ignored by the fault-finders; their eyes are fixed on that other ten per cent which does not meet with their approval. It may truthfully be said of the present day that "Uneasy lies the head that wears a crown". Time, that wonderful healer of mental as well as physical ailments, will, I feel sure, once more re-assert itself as the good physician and normal conditions will once again prevail.

Take the returned soldier problem, one of great magnitude and complexity. Primarily it is a task involved upon our legislators, Dominion, provincial and municipal. But it has also its personal aspect which should appeal to every one of us. In the first place, the soldier question has invited criticism, probably unjust criticism, from many of the soldiers themselves. We know that outside of what our Governments may do there is a wide field of activity, of usefulness, in which our citizens generally may engage their efforts and their energies. Every returned soldier who is restored to useful civil life, happy and contented, will prove an asset to our country and a tribute to our people. Every returned soldier who has shown a disposition to aid himself and who through no fault of his own is left stranded or neglected will stand as an impeachment of our citizens, a reflection upon our country, a source of unrest and disquiet, the accumulative results of which may result in national disaster. Instead, therefore, of constituting ourselves as arm-chair critics of men and policies, we should all, individually and collectively, be willing to assume our fair share of the undertakings that lie before us and to do what we believe to be for the betterment of the soldier as well as for the advantage of the state. The war, notwithstanding its terrible consequences, has taught us many useful lessons and has brought about certain reforms which in normal times and under ordinary circumstances could not have been accomplished in less than several generations. For instance, it has broken down to no small extent the barriers between classes of the people. It has created a more democratic spirit in the world. It has brought out in clearer relief our national duties and obligations and through the enfranchisement of our women has given them an equal voice in the affairs of the State. It has cemented more closely together the bonds of empire than any other circumstance in our nation's history. It has established what I trust may be a genuine and enduring friendship between the English-speaking nations. A mutual admiration for our respective countries has been created through the heroic exploits of the soldiers in the trenches and through the splendid manner in which they were supported by the civilian populations at home. Let us hope that the result of the recent Peace Conference may be the evolving of a programme the carrying out of which will restore the war-torn countries to their pre-war conditions and prevent for all time to come a recurrence of that great catastrophe which wrought such havoc in the world and which has left such a blot upon our Twentieth Century civilization. Many questions engaged the attention of the representatives at that Conference—such as the League of Nations, indemnities, demarcation of boundaries, the preservation of industrial and international arrangements, and others—the proper solution of which could not fail to make the world a happier and better place to live in. The time has been most appropriate for the discussion and settlement of these vexed questions. People's minds are in a receptive mood, after the years of physical and mental strain during the war. It was, therefore, the part of wisdom for the representatives to the Peace Conference to endeavour to allay the great spirit of unrest which is so prevalent throughout the world to-day and, in a spirit of mutual co-operation, to seek to prevent the spread of those pernicious doctrines the acceptance of which would undermine our whole social fabric.

We as Canadians should not be satisfied to play any secondary rolе in connection with any of the world's great activities for the carrying on of which we are by nature and a kind Providence so well equipped. The war has made us more conscious of our ability and of our superiority in many respects. It has made us more self reliant, less dependent on outside assistance, more conscious of our own capacity and resourcefulness. "Excelsior" should, I think, be the motto for Canadians at the present time, embodying a laudable ambition to excel and to uplift and upbuild the manhood and womanhood of our country; to make us prize and appreciate more highly our Canadian citizenship—the privileges and liberties which we enjoy as citizens of the most important member of that galaxy of nations which go to make up the great British Empire. In respecting ourselves we take the first step towards securing the respect, esteem and admiration of the other nations of the world.

Now, Mr. Chairman, I will not trespass further upon your time. It is unnecessary for me to say that I wish your organization every success. I am sure that your members always look forward with pleasure and anticipation to the holding of your annual gathering, not only because of its benefits from a social point of view, but especially because of its educational features—the opportunity of exchanging ideas; all of which cannot fail to redound to the advantage of the members of your Association. I thank you, Sir, for the courtesy of the invitation to be with you on this occasion.

THE CHAIRMAN: We have all listened with great pleasure to the very interesting address which Dr. Roche has given us. We have with us Dr. Deville, who has been head of our branch since the early eighties. Through all the phases of the work he has always been a source of inspiration and encouragement. However, I shall not wax eloquent in his praises, although that would be an easy thing to do, because the Surveyor General has retained not only our confidence but also the confidence of the head of the Department ever since he first entered upon the duties of his position. His addresses at our annual meetings are always listened to with great interest and pleasure and profit to those who have the good fortune to hear them. Without any further remarks I shall call upon Dr. Deville to address us.

DR. DEVILLE, whose rising was the occasion of hearty applause, addressed the meeting as follows:

Mr. President and Gentlemen: I thank you for your kind reception; I assure you that I appreciate it as an indication of the good feeling that exists between us.

Among their many activities the surveyors have been doing something new during the last two years—that is, assisting in the settlement of returned soldiers upon the land. This work is of special importance, not only on account of the returned soldier, but because it paves the way to a proper method of dealing with land settlement generally. I may be excused if I say a few words about what the surveyors have been doing in this connection.

The first thing that we were called upon to furnish was to submit a report upon the lands which had been set apart for settlement by returned soldiers. Large districts in the Peace River country had been reserved for that purpose and we are asked to advise as to what portions of those districts were actually suitable for settlement. We have the information in a general way, but not with great detail; and it was decided to undertake a more elaborate examination of the land with a view to obtaining the required information. It was contended at the time that no new investigation was necessary; that this land had already been surveyed and that the information should be found in the recorded results of those surveys. That, of course, was not correct. The lands had been subdivided under contract at a very low rate per mile, a rate which did not provide for a detailed examination of the country. The surveyors did what they were paid for; they obtained the information which they were required to furnish—very scanty information it was, too. But since these surveys were carried out many changes have taken place. It doesn't take many years for woodland to be changed into prairie; and lands which were under water when the subdivision was made may have since dried up. There are many other similar reasons why a new investigation was necessary. Anyway, I never saw any force in the objection, because if the Government had taken steps to procure this detailed information at the time the subdivision was made, they would have had to pay for it. They get that information now and they pay for it; where is the difference?

As a result of this investigation it was found that out of 17,000 quarter-sections about ten per cent were fit for immediate settlement. We published maps showing what quarter-sections were available; and we compiled further information in great detail which was placed in the hands of the land agents and of the Soldier Settlement Board; so that anyone who wished to investigate and to find some quarter-section that would suit him, had all the information he could desire right before him.

What has been the result of all this work? Out of the ten per cent, or about 1,700 quarter-sections, nearly 1,100 were taken during the first year. Had it not been for this information placed at the disposal of the returned soldier, probably not one-tenth of these would have been taken in that period;

and expensive land would have had to be bought elsewhere to meet requirements. So that the investigation proved to be a very good investment for the Government.

But the most interesting part of the work was in connection with the lands withdrawn from the Porcupine Forest Reserve. I should like to say a few words about it, because what was done in that particular case will probably have to be done in connection with general settlement.

We had first to locate suitable land in this reserve. We made an exploration, found a district which was apparently very good, and selected it for this particular settlement. I have not been near the place but I have seen a good many photographs of it—a winding river; many patches of prairie; little bluffs of wood here and there, just the pictures you see in the advertising matter of colonization companies, you know. We had to send out survey parties to subdivide this land. The nearest railway station was Prairie River. It was some distance from the river, in a spot not suitable for a townsite; so we interviewed the railway authorities and induced them to move the station to a more favorable location. I have referred to Prairie River as a station, but it was really nothing more than a siding. After succeeding in having the location improved, the railway administration had to be induced to build a station of some kind. Of course, our action was merely advisory; we made the suggestions, but we depended upon—required the assistance of the Soldier Settlement Board to carry them through. The railway officials were very sympathetic and promised to build a station to cost several thousand dollars. We suggested that the Board acquire all that land for the townsite and proceeded to lay it out, thus ensuring to the settler an opportunity of getting his lot at minimum cost and without the intervention of the land speculator. We made provision for the good administration of the town, with a community centre, reservation for municipal buildings, assembly hall, schools, athletic field, etc.,—everything required for the purposes of those who will live there. But the first requisite of a new settlement is roads for the bringing in of agricultural machinery, furniture, and supplies. We are not road-builders, but every party has to open some track for getting to its survey and moving on from one camp to another. In this case we did a little more than usual. A road had been started from Prairie River going south eight or ten miles, but it was not a trunk road, and something more than that was required. It became necessary to construct bridges over two fairly large rivers. Of course, a surveyor can build a wooden or a steel bridge; but we cannot stretch our appropriation too far. So we enlisted the assistance of the Department of Highways of Saskatchewan and they built these bridges, improved the road and put everything in very good condition..

Timber was not overlooked; we selected some good areas and had them reserved for the use of the settlers. All that the Soldier Settlement Board have to do now is make a contract with a lumberman to bring a saw-mill into that district, cut the timber and have it ready for the settlers so that they may be able to obtain lumber at low cost.

These are just a few of the things that have been done. It seems to me that if the rural population is to be kept on the farm instead of flocking to the cities, we must improve the conditions pertaining to settlement and production. If we are to increase production, pay off our national debt, and have something left over for ourselves, we must increase production at the farm in the first place. All that we require for our comfort and subsistence, with the exception of minerals and fisheries, comes originally from the farm. We must therefore, promote settlement; and we must make the conditions so pleasant for the rural people that they will stay on the farm in preference to going to the cities.

I thank you for your kind attention.

THE CHAIRMAN: Gentlemen, we have with us another member of our profession whom we highly honour; whose life and example are an object lesson to us. I may say that we are a good deal younger than he is, and his words of inspiration ought to be of value to us. I have much pleasure in calling upon Mr. C. A. Magrath to address us.

MR. MAGRATH: Mr. Chairman, when you started your introduction I had an idea you had your eye on me; but when you intimated that you had in mind an old man I at once looked about to see who was to be the victim. (Laughter).

I do not know that it is altogether fair to call upon me to speak, because I am a surveyor like the rest of you. In years, I am not the oldest surveyor in Canada, I certainly am not the best surveyor, but I can challenge any one to produce the number of certificates or licenses as surveyor that I hold. I believe I hold more certificates as surveyor than any man in Canada. For instance, I have a license to practice in Prince Edward Island; in Nova Scotia; in Quebec, Ontario, Manitoba, British Columbia. I am also a Dominion Land Surveyor and a Dominion Topographical Surveyor—how I managed to get the latter I am not sure.

The Honourable Dr. Roche referred to the unrest that exists to-day. We must appreciate the truth of his remarks in that respect. I do not however, think that there is any group of men who understand the causes of that unrest better than our surveyors. I assume that your experience as surveyors in recent years is the experience that I had very many years ago. After I had had a survey party out in the field in the West for six months—a year, sometimes a year and a half, I found that on returning to civilization—to entirely new conditions again, none of the men wanted to get down to work for a while; none of us seemed willing or able to settle down to the old work again. I remember distinctly that some of the very best men I had out with me would not look for employment. In other words they were quite unsettled for months after returning home again.. Now, I am speaking of my experience of some thirty years ago. I am sure it does not differ from your experience to-day. Therefore, I hold that no group of men can appreciate better than the surveyor, for instance, the unsettled condition of the returned soldier.

Euclid's method of a few centuries ago is as sound to-day as the day he adopted it, namely, to state the problem and then to look for the solution. I have a pretty fair idea in my own mind what the problem is in connection with the surveyors. I am very sorry that the chairman did not give me an opportunity of making these remarks while the Honourable the Minister of the Interior was here; but you still have the gentleman who is head of the Civil Service Commission, and my view may be of some value to him.

The problem is, of course, that of adequate remuneration for the surveyor. It is a question in fact that is concerning most men in all walks of life. If I were to seek a text for my remarks this afternoon I would take it from the remarks of your Surveyor General. No man among you has greater respect for the Surveyor-General than I have. It is true that no man can hold an office and do his duty without having some one dissatisfied here and there.

But looking back to the time when I was a young surveyor, I can say that the support and assistance given me by Dr. Deville made me his lifelong friend. I look upon him as a great credit to his profession and to his country. As for the text. You will remember his statement, that the Government got value for its money in connection with expenditures made through surveyors. I go further than that; and I know whereof I speak. From no public service does the country get better value for money expended than it gets through its corps of land surveyors. You gentlemen go out into the wilds—and I never knew a surveyor who did not work from daylight until dark when he was out in the field. Nobody kept tab on him to see whether or not he was "playing up." I never knew a surveyor who did not see to it that a good return was made to his employer, the Government. I say, therefore, in the presence of the head of the Civil Service Commission, that if we have regard to the unit cost of work—and the same applies to the engineers who go out in the field—it will be found that the work accomplished by the surveyors in the field,—thousands of miles away from his head office in Ottawa—is greater per dollar invested, than is the case of the work done by those of any other profession. Remember, this question of remuneration is one which does not affect me personally, as your Chairman evidently never expects to see me in harness again. Seriously, I am not in the business; it is years since I abandoned the surveying profession; I have no relative in the profession. I have no interest in the matter other than the fact that during the days that I was engaged in the work I learned to respect these men. And as I have watched the activities of men in other lines of work, the surveyor knowing no hours and in the matter of integrity ranks with the very highest of our citizens.

There are factors, which I fear Ministers of the Interior, with the best intention to do justice, do not properly appreciate, and cannot appreciate, as can those who have been in the field. I merely throw out these remarks, Mr. President, knowing the problem and its solution, and knowing the difficulties with which the Chairman of the Civil Service Commission has to contend. I ask him and I plead with him to-day always to keep that fact in mind when dealing with the surveyor and the engineer—the fact that these men have always given the country the very best service that any men can give.

I thank you very much, Mr. President, for asking me here. I have been very much pleased to be with you; and if our surveyors get what is due them, no man in Canada will be better pleased than myself.

THE CHAIRMAN: We appreciate Mr. Magrath's timely remarks; coming from a man of his standing, they carry weight.

The proceedings of the luncheon were concluded with the singing of God Save the King.

THURSDAY AFTERNOON SESSION

The meeting was called to order at 3.15 o'clock.

THE CHAIRMAN : The first item on our programme this afternoon is a paper on "Oblique Sun Dials", by Dr. Otto Klotz, Chief Astronomer. Dr. Klotz has been a member of the profession for years; he is known to all of us and requires no introduction.

SUN DIALS

—BY—

OTTO KLOTZ.

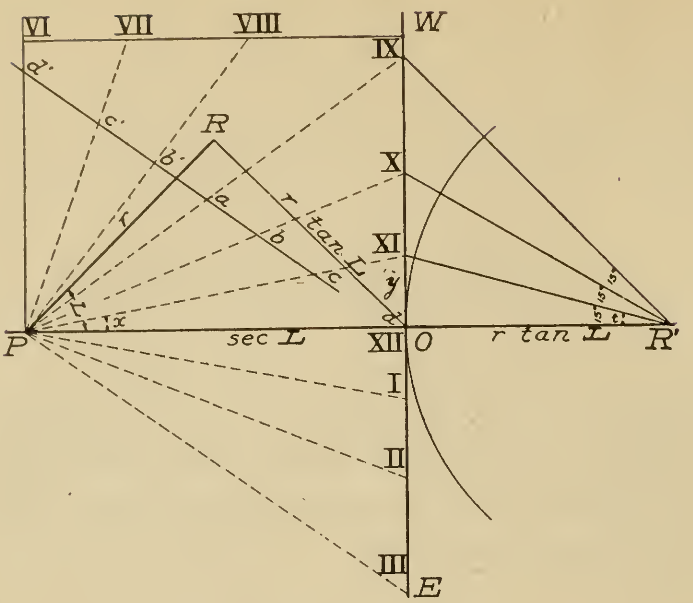
Having been requested to design the hour lines for the sun dial on the Sussex Street side of the Grey Nuns' Convent here in Ottawa, it may be of interest to write a brief paper on the subject.

The most common form of dial is the horizontal one. One on a large scale is to be seen at the Observatory here, where the hour lines are separated by flower beds.

Let us make clear a few fundamental notions:

The sun apparently moves around the earth and uniformly, whatever the declination of the sun, hence the apparent shadow of the earth's axis moves uniformly in a plane at right angles to it at 15° per hour or 360° the complete circle in 24 hours. Now the sun dial is simply a modified replica of this. The modification is that the shadow does not fall on a plane at right angles to the axis of the earth but on to a horizontal plane, and this horizontal plane makes an angle with the earth's axis equal to the latitude of the plane. We could make a dial with a rod and a disk at right angles to it, and the rod pointing to the north pole thus representing the axis of the earth. On such a disk the shadow would be seen to travel uniformly from one hour line to the next, and so on. But such a disk is inconvenient for mounting and would require graduation on the lower and upper sides for south and north declination of the sun, so recourse is had to a horizontal plane, and the problem is simply to transfer the hour lines from the disk to the horizon, which is readily done graphically or mathematically.

The rod, or stylus or gnomon is placed in the plane of the meridian and at an angle with the horizon equal to the latitude of the place. Obviously when the sun is in the meridian it is 12 o'clock sun time, or solar time or as astronomers call it apparent time.



Let P R represent the stylus, L=latitude, then the line R. O. at right angles to P R represents the trace of the plane in which the sun is moving around R, each such plane is parallel to the plane of the equator; and the line E O W represents the intersection of the above plane (in which lies R O) with the horizon.

Let us revolve the plane of R O about O into the horizontal plane where O R′ = O R, and the circle with R′ O for radius represents the uniform motion of the sun. Radial lines drawn from R′ and the angles made with R′ O the meridian, are the hour angles, and their intersection with the line W. O. E. will indicate the points where the shadow cuts the horizon. Hence any such point joined to the point P, the origin or foot of the stylus, will give the respective hour line for the dial.

The graphical construction is as follows: From R′ draw lines R′ XI. R′ X. R′ IX.—making angles of 15°, 30°, 45° with R′O, join P XI P X P IX. Beyond IX., or III., it is generally not convenient to draw the other lines, so we have recourse to a geometrical device (the pretty solution is left to the reader) as follows:

On either the III or IX hour line take any point and draw a line parallel to the other: on this line lay off a b′= a b, ac′ = a c, ad′ = a d. The last might have been omitted, for in a horizontal dial the VI hour line is always at right angles to the meridian or XII hour line; also the A.M. and P.M. lines of the same hour are in a straight line through the foot of the stylus.

So much for the graphical construction; now the mathematics thereof.

Reverting to the figure, let the length of the stylus be r, latitude L, and hour angle at R′ be t; then P O = r Sec L, O R = O R′ = r tan L, O XI = y = r tan L tan t, and the angle x on the dial for the hour angle t, is given by tan x= y/r Sec L=r tan L tan t/r sec L= Sin L tan t. Thus the various values found for x may be laid off for the respective hour lines of the dial.

It may be observed that for the large dial on the Observatory grounds the values of y were computed for the five hours and laid off on a tangent line EOW. The points were joined with the foot of the stylus, giving thus the hour lines, which may be enclosed in a rectangular, or circular, or any other design.

In designing a large dial it is well to remember that the length of the shadow varies considerably during the year, being shortest at the summer solstice. The length of the rod should be such that its shadow at noon reaches to the end of the XII line as laid out on the dial.

Let us next consider a dial on a vertical wall and one running east and west, i.e. facing due south. Our diagram is very similar to the preceding one. The rod or stylus again represents the axis of the earth and is placed in the plane of the meridian, making an angle with the vertical wall equal to the complement of the latitude. Hence the angle on the dial representing any hour angle t is given by the relation,

$$\tan x = \text{Cos } L \tan t.$$

If r is the length of the stylus, its orthogonal projection on the meridian will be r Cosec. L. y will have the same value as before, viz: r Sin L Cos L tan t. In the construction of the dial we may lay off y at right angles to the extremity of r Cosec.. L, or we may lay off the angles x from the above relation.

We see the construction of the vertical dial is almost identical with that of the horizontal one. The close relationship between the two is well illustrated by a small model readily constructed. Nail two, say foot square, boards together and at right angles to each other. Stretch a stout string from one to the other at an angle to the horizontal board equivalent to the latitude of the place, the plane of the string being at right angles to both boards. Now set the boards so that the string is in the meridian. We have now a horizontal and a vertical dial. The point to be brought out by the model is that the hour lines at the intersection of the two boards, or horizontal and vertical planes, answer for both dials. The points along this line of intersection designate or indicate the position of the points found from the values of Y above.

Now the last case of a dial to consider is the one that gave rise to this short paper, it is the case of a dial on a wall not running east or west, but making an angle (any angle) therewith.

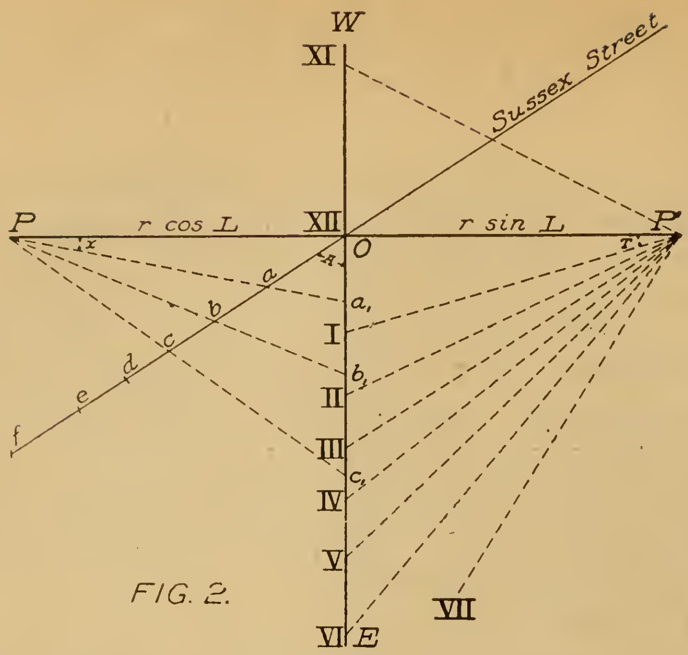


FIG. 2.

Let the rod or stylus extend from one plane to the other and at the proper angle and in the plane of the meridian. In the above diagram P and P′ are the extremities of the stylus and W O E the trace of the two planes. Obviously $P\ O = r \text{ Cos } L$, $P'O = r \text{ Sin } L$; y and x have the same meaning and value as before.

Let SX (Sussex) represent the direction of the wall on which the dial is to be constructed.

It remains to draw the hour lines on the latter wall. Let it be granted that the points for y have been established along W O E as before. Take one of them, a′ with Pa′ the particular hour line. This hour line cuts the trace of the wall at a hence a is a point on the hour line on the wall while P′, the extremity of the stylus where the shadows diverge, the other point. The angle T at P′ is given by the relation $\tan T = Oa/P'\ O$.

In the triangle Oa a′ we have $Oa' = y = r \text{ Sin } L \text{ Cos } L \tan t$; $\tan x = y/R \text{ Cos } L = \text{Sin } L \tan t$; the angle $a\ Oa' = A$, and $Oa'\ a = 90° - x$, hence Oa or $K = y \text{ Cos } x/\text{Cos } (A \pm x)$.

And therefore $\tan T = K/r \text{ Sin } L = \text{Cos } L/\text{Cos } A \text{ Cot } t \pm \text{Sin } A \text{ Sin } L$. Hence T can be computed from this expression.

The graphical solution is very simple.

Obtain the intersections a, b, c, d,......for the hour angles 1h, 2h, 3h, 4h..... given by the points a′ b c′......for the various values of y. Transfer the distances Oa, Ob, Oc......to the W O E line, whereby we obtain a graphical representation of tan T in having the two sides of the right angle triangle P′O I, P′O II, P′O III........

It may be observed that while on a horizontal dial and a vertical one in the prime vertical the six hour line is at right angles to the meridian or XII hour line, this is not the case when the vertical wall is not in the prime vertical or an east west line. The intersection F of a line through P parallel to W O E with the line S X gives the distance O F to be laid off on W O E for the point of the afternoon VI hour line. When t exceeds 90° or 6 hours, tan t becomes negative and we measure from O in the opposite direction, and obtain an intersection through P with S X, giving us the distance to lay off from O for the hour angle in the above case 7 p.m.

A closing word about solar time or the time shown by a sun-dial. Sun dials at one time served a useful purpose, but to-day are only an ornament, a sentiment, a reminiscence of the days when there were few or no watches. Although the activities of life are regulated by or dependent upon the sun, yet the sun is a very poor time piece. For the purpose of illustration of the apparent shadow of the earth's axis we spoke of the motion of the sun about the earth, of course it is the rotation of the earth that produces sun-rise and sun-set. The days as shown by a sun-dial are not of equal length, although the sun-dial shows the true solar time. The inequality of the length of the days is due to two causes. In the first place the orbit of the earth about the sun is not exactly circular but eccentric so that the motion is not quite uniform; and furthermore the orbit is inclined to the plane of the equator which introduces another irregularity in the length of the day. For purposes of life we have adopted days of equal length, that is, averaged up all the solar irregular days, into mean days. This is the time kept by watches and clocks. Four times a year the solar time and mean time are the same; on all other days a correction must be applied to the time shown by a dial to obtain the corresponding mean local watch time. It is perhaps a little too much to expect the man on the street to decipher the relationship between the time shown by a dial and our modern time-keeping. This is what he would have to do. He would have to apply for the particular day the correction, which at a maximum in November amounts to 17 minutes, to dial time to obtain local mean time. It will be observed that the word local is used, a time that is now practically obsolete in the civilized world; all local mean time having been replaced by standard time. The local mean time is the mean time for the particular meridian of the place (of the dial). To this we have to add or subtract the number of minutes and seconds that the place is east or west from the standard meridian—even hours from Greenwich—governing the time of the place. Here in Ottawa our local mean time is slow 2 minutes and 52 seconds on standard time. Having made the above two corrections, if it is summer we make another correction by adding an hour to our result, in order to obtain Day Light Saving Time.

We look at the dial, we look at our watch, and probably feel like saying "Somebody is lying". At Port Arthur this difference may be over two hours, and the plaintiff would appear to have made out his case.

The sun dial gives the correct sun-time, our watches give the time to suit the convenience of man.

THE CHAIRMAN: Dr. Klotz has given us a very interesting exposition of the method of constructing a sun dial. I wish I had had it last spring, when in connection with our work we had occasion to make sun dials. Sometimes they were oblique, sometimes horizontal—but we generally tried to keep them as horizontal as possible. In constructing it we made use of the top of a lard can, and on Sunday we would watch it all day and draw the lines as required when the shadows fell. The meeting is open for discussion of this paper.

MR. HENDERSON: We ought to feel very grateful to Dr. Klotz for his interesting address. So far during this meeting we had not had any mathematical formulae thrown at us; it is quite refreshing again to see some of these familiar looking things on the board. It reminds us of college days when we used to sit back and listen to Professor Stewart in Toronto. He would fill a board like that three or four times in an hour. We would listen more or less attentively and it would be pretty clear to us; but by the next day it would have vanished like mists before the morning sun. I think that I could make a sun dial at the present moment, but I am afraid that if I put it off until to-morrow it would not be so easy.

THE CHAIRMAN: The next on the programme is a paper by Mr. F. V. Seibert, D.L.S., on ''Clearing Land by Controlled Fires''.

MR. SEIBERT: Mr. Chairman, I have a very wide subject to deal with, and I have attempted to cover it as concisely as possible without omitting any essential points. If I have dealt with it too briefly, I ask your pardon. I have sought to approach the matter from the viewpoint of the actual work itself and thus emphasize the essential elements of the policy advocated, the difficulties to be contended with, and the advantages to be obtained through its adoption.

CLEARING LAND BY CONTROLLED FIRES.

—BY—

F. V. SEIBERT, D.L.S.

Every member of this Association has no doubt, read with great interest Mr. Rice's paper of last year on Land Settlement. My introductory remarks should properly include a large part of that paper as well as considerable of the memo sent The Honourable The Minister of the Interior by your committee last year and many remarks contained in various other papers. All aimed at one goal, an efficient and economical land settlement policy. They showed the present state of Dominion Lands not alienated or entered upon for homestead, that the soil was on the whole good but that there was very little land available that did not require some work of reclamation either of clearing or drainage before being fit for settlement. The handicap to the homesteader on account of his lack of capital and inability to produce for the first few years was well established. Very few settlers are able to improve and farm one of the present homesteads without some assistance or, in other words, without some improvement being made to the land before they come to live on it. Such improvement it was pointed out could be made a charge against the land and paid back when such land came into production, but if the settler wished to improve one of these quarters efficiently and economically without a prohibitive hardship being imposed upon himself and family the land must be brought very much nearer that state of production wherein he could hope for more immediate returns.

A progressive and efficient land policy in Canada to-day must take account of these facts and bring the homesteads now available very much nearer a productive condition before settlers can or should be induced to settle thereon. Different schemes of accomplishing this end were discussed and advocated. One of the best of these and one which offered more immediate results was controlled fires in the proper season. It was proposed to burn certain areas covered by wind-fall and brule in the spring of the year when this material has become sufficiently dry and while there is still enough moisture and frost in the ground to protect the soil.

As a direct result of these discussions with subsequent investigations and experiments we have this year the Topographical Surveys Branch undertaking for the Soldiers Settlement Board the clearing of certain areas of land by the **judicious use of fires under control.** The parties which are to do the work will arrive on the ground as soon as the snow is off. They will construct a fireguard of sufficient width around the land to be burned before the fire will run over the whole area, and finally when conditions are most favourable they will burn over the whole of the land so enclosed. The burning is to be done when it is considered the greatest results will be obtained, and when there will be no damage to the soil. This will usually be around the latter part of May but will depend on local weather conditions.

To understand what such fires will accomplish, one must be thoroughly acquainted with the usual weather conditions of Northern Alberta and Saskatchewan. Conditions are somewhat reversed to what we generally expect in other parts of Canada. The spring months are marked by sunshine and warm winds unaccompanied by rain. This dries the surface material, such as dead leaves, grass, windfall and brule, without absorbing the moisture and frost from the ground, thus making it possible to burn this material without injury to the soil.

Most men who have worked in the North of the three prairie provinces have seen what fires at the proper season and under proper conditions have done towards the clearing of that country. They have also noted the great damage done at the wrong seasons of the year and under improper conditions. They have realized for years that fires if controlled and intelligently conducted by men of good judgment, would be of great assistance in clearing the desirable agricultural land within this area, and at the same time, greatly help in eliminating those uncontrolled fires which start at the wrong season and which prove so disastrous to both timber and soil. Until there was an urgent need for its application, controlled firing as a method of clearing land was not strongly advocated. As long as these many uncontrolled fires were clearing the land and leaving sufficient of it fit for settlement to meet the immediate demands there was little hope of serious attention being paid to the systematic clearing of land by this method, although at the same time many uncontrolled fires were doing untold damage to the soil and timber resources of the country. But when the Soldiers' Settlement Board sought land for its returned men, and an investigation was made by the Topographical Surveys Branch of that area reserved by the Board, it was found that there was not sufficient land fit for immediate settlement. Then the need of further suitable land was felt and the present policy considered.

Like most new policies it had its opponents as well as advocates. Certain objections were raised by those opposed which, if true, were of too serious a nature to allow of the policy being put into practice. The resultant harm would be much greater than any benefit that would be attained. Chief of these objections were:—

1. That fires at the season of the year in which it was considered best to operate, could not be controlled.
2. That the soil would be damaged by such fires.

One can readily see that either of the above objections, if true, would warrant the turning down of the policy. Hence Mr. Lonergan and myself were sent last spring to conduct an experiment, with the purpose of ascertaining all the information possible on the subject and to prove or disprove these objections.

In this experiment we were limited to an area not greater than three sections, and it fell to my lot to explore and decide on the territory to be burned, while Mr. Lonergan organized the party.

If we wished to get a comprehensive report and to be able to tell from our experiment what Spring fires would do on all the various kinds of country to be found in the North, it would be necessary to choose an area that contained as many of the various types as possible. It was not easy to find three sections which contained all the main types of territory desired, but we succeeded in doing so.

A large number with whom I have come in contact were of the impression that our work was not an experiment but a demonstration. This, however, was not our idea of the object to be attained. Had this been our object, we could have chosen areas that would have given us much better results, but we concluded that this was too narrow a view to take. We decided that if this policy should be adopted, it would be necessary to know the results we could hope to obtain from every class of country with which we would have to deal, and what conditions would give the best results, and how best to handle those conditions. We therefore chose, not a piece of land that would give us the best results as a demonstration, but an area that would, when burned experimentally, show us what we could hope to expect from different types of country and conditions in the North. Nevertheless, our experiment demonstrated conclusively that controlled firing is an economical method of improving land and making it fit for settlement. It also taught us when, where and how to get the best results, which after all was the primary consideration, and of much greater importance than the actual burning and clearing of any small area of three sections which had been selected for its burning qualities, and burned under the most favourable conditions, and which might not be duplicated within a radius of one hundred miles.

The report of May 31st deals very carefully with the result of our experiment, and a short summary might be in order..

This must necessarily be a duplication of many remarks contained in that report, and to anyone interested in this work I would suggest a study of it.

We started work on April 15th and ceased operations on May 21st.

We complied at all times with the fire regulations of the Province of Alberta. Clause 4 of the Prairie Fires Ordinance covers this work and requires "a fire guard of not less than twenty feet in width, consisting of land covered with snow or water or so worn, graded, ploughed, burned over, or covered with water, as to be free of inflammable matter; and any person kindling a fire for such purpose shall, during the whole period of its continuance, cause it to be guarded by three adult persons provided with proper appliances for extinguishing prairie fires."

Our first work was therefore to fireguard the area, and this operation was also conducted as an experiment. We tried every method that looked at all reasonable. We found that the choosing of the location of the fireguard was a large factor in its economical construction; that it was not advisable to follow section lines but to follow open meadows, grassy knolls and creek banks even to the extent of going a few miles further. By starting fire guarding early, as soon as the snow was off, one man with a torch and three or four men with good fire beaters, consisting of a wet blanket tied to an axe handle, can first go around the area and burn off the ridges which dry out first, then they can make a second trip and burn off the hay sloughs and widen out the ridges if necessary and finally, where necessary, on a third trip, they can connect these areas already burned and so complete the fire guard.

While our guard was in no place less than twenty feet, in some cases it was from ten to twenty chains, and I have seen places outside the area experimented on where it should be even more. The main thing in constructing a fire guard is not alone to comply with the regulations but to have a guard of sufficient width to be absolutely sure that no fire will jump it. The width must be left to the discretion and good judgment of the man in charge who, to be competent to judge, must have had considerable experience with forest fires. He must take note of all the conditions bordering on the fire guard that will assist in carrying live sparks over it. Dry standing stubs with dry light bark is an example of what he must look for. One such tree near the guard might be sufficient to carry the fire across. The fire climbing the stub will cause sparks to be blown off by the wind which before they reach the ground may be blown many chains. Too great care cannot be taken with the fire guard, and it is always better to have it wider than necessary than a few feet too narrow.

When the guard was completed we started burning small areas, noting the results, for only in this way could we be sure of the best time at which to set the final fire in order to obtain the maximum results.

At the same time an area of standing brule and windfall with a good mat of grass was chosen, and a line picketed through the centre in such a way to equally divide the work of clearing. One side was cleared before it was burned and the other after, and a strict account of the time and men employed was kept. This showed that the clearing before the fire took at the rate of one man forty-four (44) hours to clear an acre, and after the fire one man eight hours for the same area. This means that it took five and a half times as much work to clear an acre before firing as it did afterwards, or, in other words, the cost of clearing was reduced by firing over eighty (80) per cent.

On May 18th, when we considered that the time had arrived for the best results, we fired the whole area, or, to be more exact, that portion of it not burned over in the experiment prior to that date.

Six soil samples were taken before the fire, and from the same places six were taken after the fire. Here too, an effort was made to get as nearly representative conditions as possible. One sample, however, was given a very severe test, a much more severe test than would occur in actual burning operations. This sample was taken in the area previously mentioned, which was cleared before the fire. A pile of logs five feet high and ten feet wide made over the spot and when burned the flames went fifty feet into the air, and it was impossible to remain closer than one hundred feet. All tests showed practically no damage to soil, and in the case of the extremely severe test mentioned above there was an increase of organic matter. (Soil Analysis made by C. J. Lynde, Professor of Physics, Macdonald College).

To one not conversant with conditions in Northern Alberta these results are hard to understand. The ground at this season of the year is saturated with water from the winter snow and the frost is out only near the surface. The hotest fire takes place where there is the thickest mat of grass and material, and it is here that the most moisture and frost is retained in the ground on account of the protection thus afforded from the warm rays of the sun. In the extremely severe test quoted above, the ground was still saturated with water, and the frost was out only to a depth of six or eight inches. Where the ground has dried out it is because of the lack of covering and protection from the sun and where this condition prevails there cannot be sufficient fire to burn the soil because of this lack of combustible material.

Now let us deal with the results of the main fire, set at a time when we had concluded from our daily experiments that the maximum results would be obtained. Wherever there was a good mat of old grass excellent results were obtained. Most of the dry material, windfall and brule not lying flat on the ground was consumed. That lying flat on the ground was in some cases consumed, but more often only reduced in size and burned through in several places, thus making it easier to handle. All green trees and willows were fire-killed, and in some cases burned completely through. The results obtained were in direct proportion to the amount of old grass which must be the chief carrying agent for the fire and source of kindling for the larger material. Of the twelve quarters experimented on, eleven are now taken up by returned men, and the only quarter remaining, I have reason to believe, is left because it is isolated from any other quarter open for entry. Most men prefer to take the full half section alloted to them. This land was taken because of its improved condition after burning.

The following conclusions are made from the results of this experiment and close observations of many uncontrolled fires this year:

(1) That firing is a safe and economical method of clearing land for settlement where the country is covered with scrub, poplar, willows, brule and windfall.

(2) That spring fires can be controlled.

(3) That the best protection against a repetition of the disastrous forest fires so prevalent in the past is the removal of the many areas of brule and windfall at the proper season of the year. This is essential if the few remaining stands of merchantable timber are to be saved, and the fire hazard to villages and settlements reduced. The catastrophe at Lac la Biche is a fair sample of what is to be expected if such districts are allowed to remain.

(4) That spring fires can be carried on without any damage to soil.

(5) That the best protection to the soil of the country which in the future must furnish homes for the settlers is to burn over these areas at the time of the year when no damage is done to it, for the experiment clearly demonstrated that spring fires scientifically carried on do not injure the soil.

(6) That the majority of fires set by settlers in the spring are not successful and accomplish very little for the reason that they are not set at the opportune time, and the interval between fires is seldom sufficient to allow a good growth of grass.

(7) That while many farmers would know how to fire scientifically, they are not in a position to do so economically and safely because in the first place, to fire a large area requires a smaller proportion of fire guard than a small area; for example, a quarter section requires two miles of fire guard, while a township, containing one hundred and forty-four (144) quarter-sections, requires approximately only twenty-four miles; in the second place, and more important, the settlers must observe and follow section lines instead of natural features.

(8) That the ideal conditions for clearing by fire and obtaining the best results require a steady wind of from five to eight miles per hour. If it is greater than this it sweeps the fire across too quickly and does not give it time to ignite the dry timber. There should be a good mat of old dry grass of not less than two years' growth, and the green grass should be far enough advanced to be a few inches through the dry grass. This

is necessary to retard the fire and give it time to ignite the dry timber. A clear sky and hot sun are necessary, for under the willows surrounding the sloughs, there is seldom good grass and you have to depend on the old leaves for fuel to carry the fire. A hot sun is required to dry them for they absorb so much moisture through the night that they will not burn satisfactorily unless they are dry. The proper time to start the fire is not earlier than one o'clock in the afternoon and at two o'clock better results were obtained.''

The question has been asked why the surveyors of the Topographical Surveys Branch are undertaking to do this work. It has been thought by some that other branches are more adapted for the work. The following are some of the reasons why Dominion Land Surveyors are best qualified to handle it:

(1) They are familiar with the country.
(2) They start survey operations in the Spring about the time firing should be done.
(3) They have a party of men who are particularly qualified for the work.
(4) They have the transportation and camp equipment.
(5) Usually the surveyor's work is close to where the burning is required or can be so arranged. He can therefore delay his survey for a month or six weeks in the spring to clear land by fire.

In conclusion I wish to say that whereas the prairie country in the north has been cleared by fires that have been out of control and under conditions that have been good, bad, or indifferent, mostly bad, we purpose obtaining more efficient and better results by **the judicious use of fire under control,** and at the same time eliminate the great destruction of soil and timber.

From the experiment conducted last spring, from discussion with practical men competent to judge, and from my own experience in the field each year of which has been in close touch with conditions in these areas, I can arrive at no other conclusion but that having in view an efficient land settlement policy, the preservation of the soils of these areas, and the protection of the forest reserves, the adoption of this policy is not only a direct and immediate benefit but an imperative necessity.

This policy has received the support of all the settlers in the bush district of Western Canada. I have yet to meet one who is opposed. It is advocated by the major portion of those who know western conditions; and was first publicly advocated by the Association of Dominion Land Surveyors.

THE CHAIRMAN: The paper which Mr. Seibert has given us has evidently been carefully prepared; the subject has been dealt with very ably. The meeting is open for discussion.

MR. NORRISH: I have listened with a great deal of interest to Mr. Seibert's paper, especially in view of the fact that I happened to be in northern Alberta and Saskatchewan during the last season on a reconnaissance of lands in connection with soldier settlement. I went through a good many areas which had been recently burned, and it was interesting to note how plain were the evidences of the origin of these fires along the edges of the settlement. The average settler has no regard whatever for the prairie fires ordinance. He thinks that firing is the only method of clearing. He waits until a high wind comes up which will carry the fire away from his place; he cares nothing for his neighbour's property. As the saying goes, he "requires an awful lot of matches to light his pipe". Of course, in some instances the fire comes back on the man who originated it and wipes out his buildings.

I have talked to a great many returned soldiers out there, and numbers of them have told me that if the Government did not carry out controlled firing they would go ahead and fire without control They said that they were not going to wait very long on the Government; they were going to burn off their places and nobody could stop them. That, I believe, is what the men propose to do in the Porcupine forest reserve. The only way to do the work properly is to get at it in a systematic way and carry it out, as Mr. Seibert suggests, in the early spring when no damage will be done to the soil; and it should be done by a body of men who can control the fire in an efficient and proper manner.

Would Mr. Seibert's scheme mean that the land would be fire-guarded in roughly triangular blocks, or has he thought of the conical form ? In the latter case the fire would be started at the wide end so that it would gradually get smaller and ultimately die down. In fact, it would slow down, so that it would not have a tendency to burn too rapidly. Has Mr. Seibert ever thought of that ?

Mr. SEIBERT: The cost of burning is practically in direct proportion to the cost of placing the fire. You cannot limit yourself to any particular shape or area to be chosen. I referred in my paper to the question of the most economic method of firing. I would not, for economic reasons, be in favour of attempting to limit the shape of the area to be burned.

THE CHAIRMAN: Mr. Narraway has been a strong advocate of the clearing of land by controlled fires, and is probably more responsible than anyone else for the carrying out of this experiment. Perhaps he would like to say something on this subject.

MR. NARRAWAY: Mr. Seibert in his paper has described the situation very well indeed. In my early days of base line work it was always a case of dodging bush fires; there is always that condition to be dealt with. We went into a district near Lake Winnipeg in 1914 and we noticed that wherever a fire went through spruce areas there was a prevalence of smoke, sparks and flying embers, and that these were more bothersome than the main fire itself. Of course, in the case of poplar areas the conditions were entirely different.

The next thing we observed was the difference in the nature of the country after the fire. In some cases the aspen was burned practically through, whereas the spruce was mainly fire killed. It is to be pointed out that whether or not you approve of firing, you are going to have it. You have it to-day and you will have it in the future. The events of the last year ought to be enough to convince anybody of that. In Manitoba, Saskatchewan and Alberta they are fighting fires from one end of the country to the other.

If a flood occurs in a particular river every year you know you are going to have that condition to deal with; you can make experiments to meet it; you can put up retaining walls and thus do something to handle the situation. At least you are no worse off than you were when you started. But with the firing you have reasonable chance of controlling; if you take proper precautions you can effect certain results.

A year ago a fire broke out in our house at three o'clock in the morning. The house was filled with smoke, and the location of the fire itself could not be ascertained. So with bush fires, if you do not know where the centre of the fire is, you cannot satisfactorily deal with it. The only way is to stop it by natural means. If you know the conditions, if you know exactly what you have, you know where you can get at that fire and extinguish it. We could have put out that fire in our house with a bucket of water had we known where to apply it.

So that behind this whole firing scheme you have the question of the clearing of land and the protection of timber. My idea of the whole thing is this: where fire protection is desired, say away in the north—in the Churchill, Athabaska and Peace River districts—find out where your timber is; find out where the areas are that you want to save, whether for reproduction or for present purposes. Find out what you want to do, and then carry out your policy of protection. Then if a settler's fire or accidental fire breaks out, you may be certain that it cannot do any damage to timber or to the villages in the district. You can let it burn, if you wish; you can stop it, or control it.

Then there is, of course, the question of the northern railroads. Rails run from Edmonton to points in the Peace River district and on Spirit river. This is essentially a poplar country, fifty per cent of the timber being rotten and of no use. There is no spruce. The soil is all right; it is a good agricultural country. What are you going to do with that country? Will you undertake some policy of clearing it up and bringing about a supply of freight for these railway lines? The only way to make these northern lines pay is to supply them with freight and facillitate settlement in the districts through which they run.

MR. CLAUGHTON-WALLIN: I have had absolutely no experience in connection with burning on a large scale, but as you know, the forester is very much interested in the burning of slash, whether on forest reserves or outside. On the forest reserves now we burn the brush; of course, that is burning on a smaller scale and for different purposes. We burn for fire protection and we burn for reproduction. On certain soil we find that after burning slash and so on we get reproduction quicker; of course we must protect the seed trees when we burn.

I was in Montreal last week at a meeting of the Woodland section of the Canadian Pulp and Paper Association, and the question of brush burning was there brought up. Of course, it is done for different purposes, but I do not see that it spoils the soil for trees as a rule, although on very thin soils if you get too hot a fire and the burning is not done at the right time, some damage might result. I cannot see, however, why it should not work out well in agricultural land. If the fire is kept under control it seems to me that the plan would work well any way you look at it, either for the clearing of the land or for the protection of the timber. I agree with Mr. Seibert that it would not do any damage to the soil; of course, that is nothing more than my own personal view of the matter.

DR. DEVILLE: I do not personally know anything more about the subject than what I gather from reading the reports. I must say, however, that in this paper the matter has been dealt with in a logical way; the arguments are well brought out, and the conclusions cannot be disputed.

This discussion as to the feasibility of clearing land by fires brings out again the point to which I have many times directed attention: that the only persons who know what is going on on the fringe of settlement are the surveyors and the settlers. No one else goes there; only the surveyors and the settlers know what is going on. What Mr. Norrish has told us about the way the new settlers are setting fire to the wood for the purpose of clearing their land has been told to me time and again. That is, of course, not new to the surveyor, but it is not known to the public. We pass an ordinance against forest fires; and of course that settles the matter; there will be no more forest fires. If the surveyors would bring their knowledge more before the public, I think it would do a great deal of good. They do not go out enough before the public. But now that the thing has been started, if there is no mishap it ought to work out well.

These things should be done before the settlers are on the ground. The time to clear land is not after the settlers are there; it is before there is anything on the ground. I anticipate some trouble; some of these shacks will certainly burn, whether as a result of the fires set by us for clearing, or from other causes; and that will have to be looked after. If we manage this experiment successfully this year it will be a good thing, because anything that promotes settlement will be for the good of the country.

MR. BLANCHET: The brule areas of to-day are the areas that were burned over say five years ago. It seems to me that we could look ahead as far as five or ten years by putting fire into these poplar regions where the soil is suitable and there is no spruce of value, and thus working out a progressive supply of brule areas five or ten years ahead. Last summer I saw a district near Big River over which there had been two uncontrolled fires, one in 1911 and the other that spring. In some places the fire had done some damage, but in other places the second fire had pretty nearly produced prairie. By September of last year cattle had been turned into that district, where they had a splendid range.

MR. SHAVER: The Surveyor General has spoken about the shacks being burned. Last summer we came across the remains of a great many shacks which had been burned. I should say that fifty townships had been burned over, and in most of these there was very little timber left. The clearing around these shacks is usually very small; protection could be afforded by burning a little stretch around them whenever there is not much danger of the fire escaping. In the spring of 1918 I was north and west of Peace River, and on one occasion when we were going over a hill I counted thirteen fires in the distance. You could see them for miles; it was just at the time of house cleaning, I imagine—getting ready for clearing the land. If we control the fires and look after them properly, we can get the land in shape for the settler at much less cost, and enable him to avoid spending all his earnings before getting any returns. The settler cannot afford to stay there two or three years without getting some returns; if his land is partly cleared and he gets a fair start, he can make a living and will not be obliged to go away from his home at certain seasons to supplement his earnings. The time that he would go away to do this is the time that he could carry out the most useful work on his land.

MR. HERRIOT: I have had practically no experience in regard to firing along the lines dealt with by Mr. Seibert. But I think that the Surveyor-General struck the keynote this afternoon when he said that the surveyors did not go enough before the public. We are altogether too reticent in our attitude. We go out into the bush a good deal; and besides, some of us—not all, of course—are unassuming and do not place ourselves before the public in such a way as to secure proper recognition. We have on hand a lot of information of value; and I think we might reasonably make a beginning in the way of bringing our knowledge and information before the eye of the public by having Mr. Seibert's highly commendable paper published in some of our Canadian journals. Toronto Saturday Night is a paper which appeals to the best intellects in the country; I think they would be only too pleased to publish such a paper as Mr. Seibert's. Of course, other papers might be suggested; I have thought of that one just at the moment. (Applause).

MR HENDERSON: At the Chateau Laurier this afternoon Mr. Jennings of the "Canadian Engineer" asked me if the Association would have any objection to furnishing him with copies of certain papers read before this meeting in order that they might be published in the Canadian Engineer. I am to have a talk with him to-morrow afternoon on the subject. So that there is one publication, a rather widely-known one, which is willing to take up the matter touched upon by Mr. Herriot—indeed, not only willing but anxious to publish these papers. To my mind such a journal as the Canadian Engineer would be a better medium than the Toronto Saturday Night or any other non-technical paper.

To come back to the subject of firing, Mr. Seibert's paper had in mind the clearing of land for agricultural purposes. Some years ago part of my work in the Topographical Surveys Branch was to look after the preparation of base line maps for publication. I remember one map of a base line in Northern Alberta. I have forgotten for the moment who the surveyor was; but this base line covered a high region of country where there were miles and miles of muskeg covered with moss. The map which we made showed two or three little patches, almost unnoticeable, where this surveyor had been able to get feed for his horses; the rest was muskeg—swamp. It developed that underneath this moss was ice several feet deep which kept the surface so cold that nothing could grow. In these two or three little fertile spots the moss had been burned off, with the result that the sun got through, melted the ice and enabled the grass to grow. I simply direct the attention of the Surveyor-General and of Mr. Seibert and others interested in the matter to the conditions in that part of the country where you could secure by firing, not agricultural land, because it is too far north, but large areas of grazing land.

MR. PIERCE: With all due deference to Mr. Henderson's remarks and also the Canadian Engineer, I do not agree that the publication of such papers as Mr. Seibert's should be limited to the Canadian Engineer. The circulation of that journal is limited to engineers who are already aware of the qualifications of surveyors—to such a degree, indeed, that they question our eligibility for admission to membership in the Engineering Institute. While it would, of course, be worth while to let them know what we are doing, I think we should go further than that; we should let the general public know. To-day the general public places surveyors and engineers in the same category. We ourselves think that we are as good as engineers, but some engineers do not think that. What we should do is cause the public to realize what we are doing and what we can do; and the only way to accomplish that is to get papers such as Mr. Seibert's right before the public. They should, therefore, be published in papers like the Toronto Saturday Night or others just as good. If Mr. Herriot will put his proposal in the form of a motion I shall be very glad to second it.

MR. RANNIE: When the farmers see the great benefits to be derived from scientific firing they will undoubtedly want to do it themselves. That is as it should be, if they do it right. If they are going to do it anyway, would it not be a good idea to instill into them the proper method of doing it? That brings us back to what has already been stated; it is not the man in the city or the engineer who wants to know how to fire scientifically; it is the farmer in the outlying districts. Hence this information could probably be most effectively given through the medium of farm journals.

MR. SEIBERT: The discussion which has taken place on this paper is indeed quite flattering to me. As Mr. Rannie has intimated, if we want to carry out this policy we must educate the public, the people who are vitally concerned. Mr. Rannie's viewpoint, though, is a little different from mine. The settler to-day is burning; you cannot get away from that. He saw the advantages of burning long before it was advocated by us, and too often he has been guided by his own narrow, selfish viewpoint; he does not see the advantage to be derived from the conversion of merchantable timber or of forest country that will later develop into merchantable timber. I would go further than the publishing of any paper such as this, which was prepared rather hurriedly. I would like to see an educational campaign carried on among the people who are vitally concerned. The Canadian Forestry Association, to which I belong, have asked permission to publish this paper. Of course, the publishing of the paper is a matter for the Association; it can do as it thinks best.

With regard to the muskegs that Mr. Henderson spoke of, that is a question which I purposely refrained from dealing with in my paper. We have before us a field of activity in connection with which we can get an immediate return; that is a field that we have to enter upon right now. But I can show you spots where trench fires have converted muskegs of tamarack and spruce —which, as you know, are considerably different in their constituents—into good hay lands—a thick sod, with grass as high as your waist. I remember one place down near the Colinton Rapids, inland about eighteen miles on a creek near Drop-Off Creek—it came down through the hills into the muskeg—where we dug into one place which we thought was natural land and found the constituency to be exactly the same as that of the muskeg alongside. There was the creek that provided the drainage; the old camp-fire of the Indians was right on the edge of the muskeg. Year by year fires had swept over the area, burning back as far as they could, until they extinguished themselves in the wet muskeg. Here the fire and the muskeg acted together in the production of a hay meadow.

One other point. Mr. Lonergan has not said anything about it, but a good many of the ideas I have brought out in this paper are ideas of Mr. Lonergan's, and I would not feel that I was doing him justice did I not give him due credit for them. (Applause).

MR. C. F. AYLSWORTH: I wish you to accept the greetings of the Ontario Land Surveyors' Association. We are in a prosperous condition and are endeavouring to make some progress in bringing our Association to the front and in showing the public what surveying is, what surveyors can do, and that kind of thing.

The history of surveyors throughout Canada is unique. Surveyors are the path finders, the fore-runners of civilization in this country. They were the ones who carried out the great public works. They were the ones who built the great Canadian Pacific railway, the greatest feat of engineering in the world. They were the ones who built these great bridges and these great towns.

The Ontario Land Surveyors have what we call a Biographical Committee. This committee collects information pertaining to the history and the achievements of all the old surveyors. Mr. Willis Chipman is in charge of this branch; I sometimes give them a hand myself. Last year Mr. Chipman collected biographical sketches of some thirty surveyors, and to show you what "second-rate" men they are, I will mention a few of them:

Joseph Hobson, an Ontario land surveyor, built the St. Clair tunnel. Of course, that was only a "second-rate" job; a plumber could have done it.

Then we have H. A. F. McLeod, an old surveyor. I say without fear of contradiction that he is one of the greatest surveyors extant. I have been over his work; it is uniformly accurate. H. A. F. McLeod was on all sorts of engineering works all over the Dominion. He was at the driving of the last stake in the C.P.R.

Mr. William Murdock, who surveyed the township northeast of where I live is another of the old-timers. He was on the original construction of the C. P. R.; by exploration he located the points that the road was to take in between Fort William and Winnipeg. He also laid out the crossing of the river at Fort William. He also took the first locomotive across on the ice, the "John Haggart". Any of you who have been at the Royal Alexandra Hotel have seen that old locomotive there. He took that old locomotive across the Red River on the ice, and he took also enough rails to lay two hundred miles of track west of Winnipeg. He made explorations away back in 1872 from British Columbia away around through the Peace River district and back to Winnipeg. Here is a list of all his achievements as a surveyor—one of the greatest men in Canada; and after all these achievements he goes back to surveying again—back to his first love.

We are trying to be progressive in Ontario. You have been using iron posts for marking corners in the great Northwest surveys. We are trying to adopt these all through. It has taken a good deal of what you might call propaganda, but we have at last accomplished our end and they are now going to put in iron posts at all corners in the new townships surveyed in the future. The other day they published an advertisement for about three thousand iron posts to be used in this year's surveys, similar to the post that you have adopted. Imitation is the sincerest form of flattery. In addition to that, we want to get them to re-post all Ontario the same as they have re-posted Manitoba and the Northwest Territories that were originally posted with wood.

I must say that I have written to Dominion land surveyors at Ottawa asking them to prepare papers on this thing; I have written until I got tired of writing. But we have accomplished something, and we want to go on with this step and carry on an education campaign until we have induced the powers that be to put in these iron posts. The Dominion land surveyors in Ottawa whom I asked to prepare a paper on this subject would say: "Oh, I don't see how you get time to look after these things; I haven't time here in Ottawa to write a paper". Finally I had to write to Chataway in Winnipeg to prepare a paper. The Surveyor-General kindly prepared a paper this year; it will be in this year's proceedings. I thank you for this opportunity of conveying to your Association the greetings of the Ontario Land Surveyors and of wishing you prosperity in all your endeavours.

THE CHAIRMAN: Now we will come back to the discussion of Mr. Seibert's paper.

MR. HERRIOT: I wish to urge again the need of more publicity. I do not know that the publicity should be made particularly through the medium of engineering journals, because the engineers know what we are doing. Moreover, I do not know whether the frontiersmen get in touch with these farming journals or not. But I do say that in order to secure recognition the surveyors should place what they know before the general public, not simply before one section or class of the public. It seems to me that we cannot do better than have such papers as this published in journals of the type that I have mentioned—journals which come before the general public—the reading public, the most intelligent class of the people. I move, therefore,—

> That the paper read by Mr. Seibert be offered for publication to the following periodicals:
>
> Toronto Saturday Night;
> Winnipeg Free Press;
> Montreal Family Herald and Weekly Star;
> Ottawa Citizen.
> Canadian Forestry Journal;
> Canadian Engineer.

The first three are read practrally throughout the whole Dominion; one reaches one class of the people, another another, so that by publication in these and other mentioned we will get our views and our work before the reading public generally.

MR. PIERCE: I have much pleasure in seconding the motion. Another paper of the same type would be the Montreal Standard. There are many papers in Canada which are read by the better class of citizens; and these are the people that we want to acquaint ourselves with.

The motion was adopted.

The meeting adjourned until eight p.m.

THURSDAY EVENING SESSION.

The meeting was called to order at eight o'clock, the President in the Chair.

THE CHAIRMAN: The speaker for this evening is Mr. H. F. Lambart, B.Sc., of the Geodetic Survey Branch; his subject is "Aerial Photo-topography".

AERIAL PHOTO-TOPOGRAPHY.

—BY—

H. F. J. LAMBART, B.Sc.

Aerial Photography, Earliest Records.

Obtaining photographs from high altitudes attracted but little attention in the early days of photography. The first reference to any such attempt seems to have been in 1858 when Nadar and Goddard made some attempts from a balloon without success. There is no doubt, however, that the first successful balloon photograph was the view of Boston made in 1860 by Prof. Samuel A. King and J. W. Black. This very excellent photograph taken on a wet collodion plate will be shown later on the screen.

Remarkable Development During the War.

After a slow and rather erratic career, aerial photography suddenly came into prominence with the coming of the heavier than air machine. The war has been the means of its present high state of development.

In August, 1914, the fruitful reconnaissance by a number of aeroplane observers on the Yser, the Marne, and the Aisne Sectors, drew attention to the value of this method, but it was not until the discovery that the Germans were using an apparatus for aerial photography, that the need was realised for installing a regular aeroplane photographic service at the front. In December, 1914, a section of aerial photography was created in each of the French Armies ,being exceedingly rudimentary. At first a very limited number of proofs were struck off but the importance of the service rendered by this branch after the Artois offensive of March and June, 1915, soon led to the general use of photography throughout the army and caused the distribution of thousands of proofs amongst all ranks.

In September, 1915, a section of photography was added to each esquadrille of an army corps besides those employed with bombing and reconnoitering. These newly-installed sections were each provided with an improved laboratory motor car with two 13 x 18 cameras having a focal length of 0.26 meters and soon afterwards with 18 x 24 cameras having a focal length of 0.52 meters.

For the preparation of the Somme and Champagne offensives in April of 1917, many of the sections were required to turn out daily four thousand prints from some forty negatives.

To the apparatus already mentioned were added cameras of the dimensions 18 x 24, cameras with a long focal length of 1.2 meters and the separate plate holders heretofore used were replaced by interchangeable magazine holders, holding a dozen plates Automatic apparatus of various models were also constantly added to the service, proving highly valuable.

In January, 1915, the service of the Royal Flying Corps, was equipped with a central laboratory for each army and a photographer for each squadron. The exposed plates were carried by motor cycle to the central laboratory where developing, printing, etc., was attended to.

The cameras employed in the British military aviation were all of the dimensions 10 x 12½ cameras with a lense having a focal length of 0.2 meters to 0.3 meters. At first flexible mountings to the fusilage or body of the aeroplane, was the common method used to absorb as much vibration as possible. These models were later abandoned. The use of the telephote lense is said to have failed. For obtaining detail, large scale photographs, long focal length lenses were used instead.

Contact prints were rarely made, since, the English Service was provided from the very beginning, with enlarging apparatus, enlarging to 16 x 21 cm. or to 40 x 50 cm.

The first results obtained were distinctly superior to those of the French Army due to the use of the Ortho-chromatic processes i.e. plates sensitive to orange and yellow light, in conjunction with the use of the ray filter, and appropriate sensitive papers yielding sharp contrasts.

During the progress of the war the English photographic sections were very largely extended. It was due to the English photographs alone that the Hindenburg line was discovered in March, 1917. In the same year nearly all cameras were fitted with semi-automatic devices for changing plates, etc., and it was only left to the photographer to determine when to make the exposure.

Progress in the German Army.

Long before the war the Germans made extensive studies of aerial photography, but in spite of this it is admitted that the lenses proved distinctly inferior. A statement such as this, seems hardly creditable when it is generally conceded that a German lens in a camera is the acme of perfection. Nearly all their cameras were designed to be held in the hand, and not much reliance was put on mounting the camera so that a more or less vertical line of sight would be obtained; in consequence nearly all their photographs are of the oblique type.

Conclusions, Progress During the War.

In concluding this short account of the rapid strides made in aerial photography during the war, it is seen that the requirements in peace time will differ greatly from those during the war.

There will be no further need for high altitude flight for the purpose of safety, necessitating thereby greater expense and the use of the cumbersome long focus cameras; instead, other things being equal, it will be more economical to fly at comparatively low altitudes with the use of as wide angle and rapid lenses as possible.

During the war no very great attention was paid to the maintaining of the line of collimation of the camera vertical, or, in other words devising some means of obtaining a photograph of the terrain on a plate held in a horizontal plane. They were contented with a photograph showing in detail all the features of the ground, which could be put into a machine and projected on a copy of one of the accurate maps of the country and enlarged, distorted or reduced, until those features on the photograph common to both, fitted over one another. This could then be printed on bromide paper, enlarged or reduced according to the scale required, and used as a part of a ''Mosaic''. From information obtained from the ''Mosaic'' a complete detailed map could be constructed, filling in between what could be termed control features already, established by the Ordnance Maps.

The ''Mosaic'' fulfilled all the requirements of the case and it is easily understood why no attempt was made to try and develop the art of constructing a topographical map, showing not only the horizontal position of all features of the terrain but as well elevations by contours.

Photographs Viewed Stereoptically.

Added to this was the immense amount of information that was obtained by examining photographs stereoptically. By this means any two consecutive photographs, where they overlapped, were taken and when put into a stereoscope, objects upon the ground were seen in relief by which it was easy to detect slight differences of elevation as that for instance of a platform. whether it was a few feet above or below the ground, the depth of a trench, and whether the parapet was constructed of sand bags or thrown up earth, etc.

Stabilizing.

The most pressing need in aerial surveying is that of stabilizing the aeroplane camera. Any deviation of the plate from the horizontal position produces a distorted picture of the area photographed, and a deviation greater than a ¼° (52 feet at 10,000 feet) will probably introduce errors larger than those allowable in a modern topographical map, the error increasing with the altitude at which the photograph has been taken. Many stabilizing devices have been proposed, but none have been entirely successful. Most of them depend on gravity, to hold the camera in the required position to agitate level bubbles which shall register the amount of the tilt; or to perform some similar work. Such devices are not altogether successful, because the movement of the aeroplane does not allow gravity to act unhindered. Any device that depends wholly on the action of gravity is therefore inadequate. It is likely the gyroscope will be utilized in solving the problem. Cameras constructed embodying the principles outlined above, are already on the market, and will be dealt with separately later on. Results of recent experiments carried on by the U. S. Geological survey with a camera mounted as a pendulum whose movement is damped by gyroscope, is said to have given encouraging results, but the errors are still too great to permit the photographs to be used in constructing maps. It is considered that the application of the gyroscope to the stabilization of a reference point, from which the deviation can be measured gives promise of success, for such an apparatus will have less work to do than one intended to stabilize the whole camera, and can therefore be made more accurate, lighter, less elaborate and at much smaller cost. With regard to the recording of this stabilized point, on each photograph taken, an auxiliary camera might be used to photograph the face of an illuminated gyroscopic compass as well.

An ingenious method has been put into practice in some surveys made in Egypt in which by means of an auxiliary camera a small photograph is made on the same plate, of the horizon, and from its dip and inclination to two cross lines, the inclination of the plate is measured. This obviously does not lend itself to much refinement.

Corrections for Distortion.

After all the photographs have been corrected for tilt and brought to the same scale it is still necessary to make corrections for distortion caused by relief of the area. Prominent elevations above the ground level, such as hills or mountains, will appear to be more distant than they really are, and depressions below the general level will appear to be too near. In photographs of regions of low relief, such as the prairies, the distortion is slight, but in photograhps of areas of moderate or greater relief it is considerable. A method of correcting such distortion is necessary to produce an accurate plan as well as a contour map. An application of the principles of stereoscopic vision may furnish one of the means of solving this problem, as for example, by two cameras taking photographs simultaneously, and mounted, one at each end of the wings, the wings acting as a fixed base between the cameras. The negatives from each camera being placed in a comparator, it is now possible to measure all the elements necessary to fix any point, appearing in both photographs, in position and elevation. The two necessary conditions only being that the negatives have both been taken in the same plane, and that the length of the base between the cameras is known.

Flying at a Uniform Height Desirable.

The problem of flying at any given altitude in order to maintain a uniform scale, in a series of pictures has been considered. If an aeroplane flying at an altitude of about 5000 feet rises or falls 100 feet while pictures are being taken, the change in altitude introduces an error of about two per cent in the scale, with a 12 inch focal length lens, in two overlapping photographs. As a matter of fact this is a very much exaggerated example, as a machine can be flown at this elevation and an almost constant elevation maintained. In matching up distorted pictures taken with an unstabilized camera to form a "Mosaic", this change of scale cannot be found, for, in addition each photograph shows differences in scale due to the tilt of the camera. In photographs taken in a horizontal plane or in rectified pictures, however, differential changes of scale are eliminated, and the change of scale due to the change of altitude is corrected by simple enlargement, or reduction. Flying at a uniform altitude is not therefore of prime importance, but it will do away with much of the labour of enlargement and reduction.

Direct Methods of Determining Altitudes.

At present the only direct method known to determine the altitude at which a pilot is flying his machine is by the aneroid, and as every one knows this depends upon air pressure and is a very unreliable means of measuring altitude. This instrument, therefore, can only be used as a check for any aerial photographic work undertaken in the future.

The photographic image, on a plate held in the horizontal plane, of two known points on the ground itself will give a measure of the altitude. By the same means when a camera is held so that the plate is vertical and receives the images of three known points, the elevation and position of the machine may also be found.

Apart from these methods, as far as I know, we have only left the indirect method of determining elevation by fixing the position of the machine, at a given signal by simultaneous readings on it, from two known points on the ground.

Rectifying Camera.

Previous reference to the rectifying camera has been made. In every case where a picture has been taken, inclined to the horizontal, it must subsequently be corrected for this inclination. To accomplish this end, the negative is placed in the rectifying camera and an enlargement made on an inclined surface, applied to correspond to that at which the negative was taken, but opposite in direction.

Focal Plane Shutter, Error of Same.

In passing, a reference might be made to the focal plane shutter which is nearly universally used on all aerial cameras. The principle of this shutter is the passing of a slit in a screen across the face of the plate near its surface, in this way admitting a pencil of light to pass across the plate. By this means the plate is exposed uniformly but not all at the same time, with the result that the plate has uniformly distributed over its surface not only what is beneath the machine at the instant the shutter starts to open, but as well the ground covered by the flight during the time of exposure. This distortion is really of a very small order with the fast exposures generally made, but in any event, can be more or less corrected, by having the shutter travel across the face of the plate in the same direction as the machine is travelling.

Theoretical Synchronization of Ground and Film Speeds.

An ideal condition suggested by Mr. Dickison, hardly to be realized, however, would be found in synchronizing, with the ground speed, the speed of a continuous strip of film, passing across an open slit.

Use of Orthochromatic and Isochromatic Plates and Contrast Sensitized Papers.

Ordinary photographic plates in which the light sensitive material is the silver holders, are sensitive only to the ultra violet, violet and blue regions of the spectrum. They are almost entirely non-sensitive to the yellow and red. In all forms of out door photography it is essential to have plates and films sensitive to these other colours of longer light wave. On the market are such plates as ''Orthochromatic'' and ''Isochromatic'' which are sensitive to the green and yellow in addition to the original blue violet sensitiveness.

The ''Ilford Panchromatic'' plate is spoken of as undoubtedly the best plate used in the war. Combined with the use of highly contrasting sensitized papers, these plates have given a wonderful degree of clear, minute detail.

Haze and Ray Filters.

This short discussion of the use of plates and films sensitive to the yellow and green light has been introduced as it bears directly on the use of the ray filter, universally used in all camera work for the elimination of haze when distant landscape is being taken.

In aerial photography the penetration of this almost omnipresent ground haze by filter is easier from above its upper light than within its area. This haze varies in height and density but is said to extend on an average up to 5000 feet, and is caused by both optical and mechanical turbidity.

Altitudes, Best at Which to Fly.

This brings us to the question of which is the best altitude at which to fly. Granted that clear definition is not lost by altitude—of course within reasonable limits—there are many arguments in favour of high altitude flying. Besides the better penetration of the ground haze, a greater safety is secured for the pilot and surveyor, in case of any trouble. At 11,000 feet he would have 400 square miles in which to choose a landing in good weather, or a radius of from 8 to 10 miles in every direction. At high altitudes rarified air pockets disappear with the attending advantage of being able to maintain a more even keel and straighter course. A greater latitude is also given exposure time. With an allowable maximum error of 1/100 part of an inch in the displacement of an object on the plate; at 10,000 feet an exposure of 0.5 sec. could be given with a 12 inch focal length lens.

Theoretically it would not be advisable to make it quite as long as that. due to vibration and momentary angular displacement of the machine, but it serves to illustrate the point. Generally speaking photographic scales are too large and cumbersome, for instance, even at this altitude of 10,000 feet the scale of a negative of a 12 inch lens would be 1/10,000 or 0.158 miles to an inch. This, however, is not serious as the scale is directly controlled by the change in the focal length of the lens.

It would appear, therefore, that it would not be advisable to fly at any lower altitude except for very small areas, where the cost of making the high ascent would come in as a larger factor.

Of course it is readily seen that the higher the altitude the greater the ground covered, with consequently shorter time of flight required to cover any section of territory.

Cameras and Apparatus on the Market.

There are at present at least three cameras on the market that are making a bid to give the surveyor from the air, pictures on plates or films held in a horizontal plane when the photograph is taken. It is not known whether these are entirely satisfactory and this we cannot determine before a careful test has been made.

The Williamson camera made by the Williamson Kinematograph Company of London is stabilized by means of a gyroscope; of very interesting and rather complex construction. A general description of the apparatus follows.

It consists briefly of a 8¼ x 4 inch automatic electrically driven film camera, mounted in gimbals, combined with a gyroscope arranged to retain the axis of the camera always vertical; and a wind driven electric generator to supply energy for the camera and gyroscope. Control switches are also provided for the stopping and starting either gysoscope or camera, and a further control is arranged for stopping the generator when the latter is not required.

The generator is designed to be secured to the aeroplane in some suitable position in the slip stream—(stream of air driven aft by the propellor) and connected to the apparatus, via the control switches by means of a multiple cable. It is driven by a 24 inch fan and with an air speed of 80 to 90 m.p.h.

turns over 5000 r.p.m. which supplies the camera motor and gyroscope, which revolves at 20,000 r.p.m.

The apparatus proper is supported on an iron standard in which the gimbal frame is pivoted. On this frame are attached the gyroscope and camera, both being independently pivoted in the gimbal frame, with the axis at right angles to the pivots of the latter. The gyroscope and camera, however, are connected by links, so that the axis of the camera remains always parallel to the axis of the gyroscope, yet the two axes are free to move together in any direction in relation to the aeroplane. A portion of the gyroscope apparatus comprises an ''erector'', the function of which is to return the axis of the gyroscope to the vertical, should it become displaced, and further to insure verticality when the apparatus is first started. The film is 25 feet long and 4 inches wide and with 8¼ inch length of picture in the direction of flight would give about 35 pictures. I have seen no printed cuts of this apparatus but from reports made of it by the R.A.F. it would seem very complex in construction, and the prompt action of the gyroscope—as it is said not to be very powerful—is rather uncertain.

The Eastman Camera.

The Eastman Kodak Company have just recently developed a camera which records on each negative taken, the inclination of the plate in two directions. The picture is 18 x 24 cm. in size and is taken on a film roll 70 feet in length which is capable of 100 exposures before it becomes necessary to re-fill the camera. The camera is fitted with three lenses giving the effect of a very wide angle lens of 120°. Three pictures are made simultaneously on different planes which are afterwards all reduced to the horizontal.

The Brock Camera.

The Brock camera is also of the continuous film type of 100 exposures, and there is also a model which can use plates which are automatically changed.

The stabilizing is done by swinging the camera in gimbals so as to hang free by from a point as high above the centre of gravity as possible. Oscillation is prevented by means of dash pots or small buffer cyclinders.

All these three cameras are fully automatic, that is they are operated by a wind motor or clock spring (as is the case in the Brock) to automatically expose and change the plate or film.

When it is desired to commence a series of photographs a dial is set to give the number of photographs to be exposed per minute as the machine is in progress. The number of photographs required to be taken per minute will depend upon the height of the machine, the ground speed and the overlap required.

Multiple Lens Camera.

The U. S. Geological survey have experimented with a three lens camera similar to the Eastman camera just referred to, giving three photographs inclined to one another which afterwards may be transferred to one plane thus combined—as previously stated—to produce an extreme wide angle view. This camera also gives an angle of 120°. If a fast lens with an angle of view as great as this could be constructed it might yield pictures as serviceable as those made by the multiple lens camera; but all wide angle lenses are slow, and in extreme wide angle lenses the marginal illumination is poor. Hence the multiple lens camera is well adapted to do much of the work that may be done in aerial surveying.

A good deal of doubt is felt over the satisfactory behavior of any of these cameras. A camera stabilized by a gyroscope is going to be difficult to handle; one held vertically by the action of gravity is seriously affected by changes of velocity and centrifugal force. The recording of the position of a bubble on each plate is subject to the same forces and combined with all this the displacement that is possible, due to excessive wind pressures. All these difficulties will no doubt have their solution in time.

Uses to Which Aeroplane Photographs Can be Put.

Experience in the revision of surveys has taught that it costs as much as the original survey; and it is here where the aeroplane will be at first of the greatest service by a comparison of the photograph with the original map.

If it is shown that photographs taken over the water will show the outline of dangers to navigation, there is here also a vast field for the aeroplane in making photographs over areas where it is known that many obstacles exist.

There are many hundreds of square miles of country where there is an immense amount of topographical detail which could be shown accurately enough on the map by the aerial photograph after the main features have been accurately shown by the ground survey.

The Value to the Town Planner.

To the Town Planner there is no map constructed that can approach in value the plane ''Mosaic''. Apart from an accurate map from which to scale distances and obtain accurate differences of elevation, the ''mosaic'', I venture to say, will fulfill the larger part of his requirements.

The amount of detail is unlimited, not only showing the complete outlay of streets, railway and street car systems, bridges over the water courses, character and kind of the trees in the city, the extent of their shaded areas, etc., but as well could be used in a very accurate study of traffic conditions, the extent of its volume by taking photographs at critical or peak load hours during the day. Combined with oblique photographs, he would be supplied with a vast amount of information, which by any known present means would represent weeks of labour.

Exploratory Surveys.

For Exploratory Surveys, over great expanses of country where very limited control exists, it is difficult to conceive of any more valuable means than that at present at our disposal. With a multiple lens, wide angle camera upwards of 3000 square miles could be photographed in a single day, these photographs, besides showing the complete drainage system and all topographical features, would show as well, the extent and character of timbered areas, and swamp lands. The rock exposures and geological formations—that are seldom if ever well shown on the most carefully made topographical maps—would be shown distinctly and, if examined stereoptically for many purposes might yield all the information desired.

The photographs would be invaluable for any subsequent forms of reconnaissance work, as that for instance of laying out a triangulation system, and for all preliminary forms of water power development surveys as drainage areas, and storage capacities of lakes, etc. In time, as the control gradually spreads over the country these photographs could be used in the compiling of all maps of the country. The value of these photographs is much enhanced when it is realized, that although sometimes slightly distorted by tilt, the relative positions of points not far apart, are not seriously affected.

Aerial Traverses by this Method Greater than a Half Over-lap.

Taking for granted that we have a series of photographs taken with a well stabilized camera and so taken that each photograph will overlap the one next proceeding it by an amount which is somewhat over a half, a plot or traverse of the path of the machine on the ground can be made. The ends of the courses are marked by the point on the ground immediately below the centre of the lens, and normal to the plate.

By a simple geometrical construction the position and elevations of these points can be found as well as the elevation of the machine at the instant at which each photograph was taken, provided, to commence with, we have the position and elevation of two or more fixed points.

From these determined positions and elevations of the normals to each photograph, the position and elevation of any other point shown can be plotted, and hence we have the information necessary to construct a topographical map.

Control.

The question of obtaining adequate control by triangulation system, over any country to be surveyed can never be dispensed with, so that in all cases the aerial photo-topographer will have to work hand in hand with the ground surveyor. Triangulation stations would have to be marked, or the location made of prominent features of the country easily identified in the picture, in order to fix these points of control for the photo-topographical work.

Summary and Conclusions.

In conclusion, it may be said that the surveying from aircraft is entirely practicable, but has not yet been brought to the point where it supercedes ground topographical surveying—which it is never likely to approach in accuracy.

Many problems remain to be solved.

It is destined to be one of the most specialized sciences.

It is an engineer's job to lay out what control is necessary, and it is the engineer's job to finish the map from pictures, but only an engineer thoroughly familiar with the conditions of flying and aerial photography can intelligently handle these co-operative projects.

It is hoped that the Government will sufficiently realize the value and importance of this new asset and encourage by every means possible its development.

THECHAIRMAN: Mr. Lambart has dealt with the photographic end of the subject. Major McLaurin was to have taken up the practical flying end of it, but he was unable to attend, and Colonel Leckie, of the Air Board, has very kindly offered to come here in his place. Colonel Leckie has been overseas and knows all about the practical end of flying; we shall now have a few remarks from him.

LIEUT.-COLONEL R. LECKIE

(Director of Flying Operations, Canadian Air Board):

Mr. Chairman, Ladies and Gentlemen,—It has given me great pleasure to listen to the very able paper of Mr. Lambart; it has been most interesting and instructive. Mr. Lambart has dealt with the various problems connected with aerial photo-topography; my part is merely to show you a few pictures of the machines that I hope we shall have flying in Canada this spring and summer. As you know, the Air Board is now functioning, and we hope that one of our duties will be to assist the Surveyor-General in the surveying of parts of Canada. Owing to the generosity of the British Air Ministry we are already in possession of over one hundred airplanes, seaplanes and airships; I will show you pictures of some of these presently.

From the flying point of view I thoroughly agree with everything that Mr. Lambart said. I have done a little photography overseas, and I know the limitations to be exactly as he has described them. While the results obtained are interesting and useful, they are not yet accurate and cannot begin to compete with the results obtained through ground work. However, we are hopeful that in time these difficulties will be overcome.

> (Here moving pictures were shown and explained by Colonel Leckie, illustrative of different types of machines coming into the possession of the Air Board. Their different characteristics and performances were briefly outlined).

THE CHAIRMAN: These pictures have indeed been very interesting and instructive. The meeting is now open for discussion. Mr. Lambart will answer any questions regarding the photographic end and Colonel Leckie will answer any regarding the practical flying.

MR. SEIBERT: Mr. Chairman,—I have listened with a great deal of pleasure and interest to the remarks of both the speakers of the evening. I have not had a great deal of experience in flying, nor do I know very much about the photographic end of it; but both Mr. Lambart's paper and Colonel Leckie's remarks explanatory of the different types of machines have been intensely interesting to me. No doubt many of the surveyors have felt like I have when out on some of these base lines on exploratory work in the north I remember as far back as seven or eight years ago sitting on the shore of a lake and, knowing that I could not get home for two days and that the trip across the muskegs, through streams and over other natural obstacles would entail a great deal of hardship, I pictured as I looked into the campfire a hydro-aeroplane coming down and taking me over to the lake that was in front of our camp. At that time, of course, flying was in its infancy, but we could see in a dreamy way the possibilities of the future. Although I had thought considerably along these lines I never saw any possibility of getting away from my work to take up actual flying. When the war came on and the Royal Flying Corps kindly raised the age limit, I was permitted to learn a little bit about flying, and I went into it with that as at least one of my objects—an attempt to ascertain what use could be made of aeroplanes in the work that we were engaged in. I saw then, very dimly, great difficulties ahead, and some of these I still see. As a matter of fact, when we come to look into the matter thoroughly we see difficulties that we did not see at the start. But there is a great future for work of this kind. I have not since my discharge had time to co-ordinate my ideas along these lines. I should like to ask Colonel Leckie what is the estimated cost per hour for the operation of a machine of such a type as we would use in the North, with a speed of one hundred miles an hour and a carrying capacity of one thousand pounds. In an address before a meeting of aviators in Montreal Colonel Biggar made mention of a cost of $100 per hour, I think; is that correct ?

LIEUT.-COLONEL LECKIE: That is correct.

MR. SEIBERT: Well, there are a number of base line men here, and I would like to make a practical application of that estimate. It has been mentioned that a 120 degree camera, Eastman kodak, can be used on this work and would obtain sufficient accuracy for that purpose. One of these machines flying at an altitude of 10,000 feet would give about six miles of a picture. That would entail, roughly, four trips, with probably two more for overlaps. It would entail four trips parallel to the base line; the base line itself would be a control for two of the trips. The other controls could be established with a degree of accuracy that would be decided on. But that would be four times 150 miles of flying, or 450 miles, which, at an average speed of 100 miles an hour, would occupy four and one-half hours. If it was one of the base lines immediately north of Peace River, I assume that the landing ground would be at Peace River crossing. Well, adding an hour on either end for getting to and from the work, you have six and one-half hours, making the cost $650 for photographing the area in question. This calculation has just occurred to me; I have not had time to go into it in detail. Now, our explorer obtained the topography of that country—but not with anything like the degree of accuracy to be obtained through the making of these photographs—and the cost, including wages and overhead expense, would be about $1,000. That is just an instance. I think that we would do well as an Association if we got together and offered our services to the Air

Board and to those interested in this matter. I should even go so far as to say that we should have a standing committee who would have this subject entirely under their control, or would at least devote their time wholly to it. I leave that with you merely as a suggestion.

THE CHAIRMAN: That $100 an hour has nothing to do with initial cost; it is actual operating expense, I understand.

LIEUT.-COLONEL LECKIE: The $100 would cover the operation, depreciation, and interest on investment. That is a very rough figure; it would vary in different operations. In the operation of aircraft it is necessary to run every machine to its utmost capacity if you wish to bring down these standing costs, depreciation and overhead. On various operations we have figures that the cost is about $1 a mile or $100 per flying hour. I might supplement the last speaker's remarks by saying that we have had under consideration an operation from Athabaska Landing to Coronation Gulf. Most of you surveyors know what a rough, unsettled country that is; as a matter of fact, the amount of work to be done in that country would not, I am afraid, warrant the undertaking of the operations. But I understand that it takes two months and a half to get to Coronation Gulf down the Mackenzie River and along the coast. I see no reason why we should not make the trip in one day. That indicates the saving of time effected by the use of aircraft.

DR. DEVILLE: On behalf of those present here I wish to thank Colonel Leckie for his very interesting moving pictures. I am sure that everyone has been very much impressed by the pictures; they are something quite new to most of us—to me, at any rate.—Mr. Lambart also gave us a very interesting lecture.

The first man who attempted mapping by aerial photography was a man named Scheimpflug, an Austrian. He left the Austrian navy, to which he had been attached as an officer, and went to the United States where he was connected with business, I understand, for a little while. He came across a book which I wrote on the subject of photographic surveying in which I suggested—of course, that was in 1905—that mapping was possible by aerial photography. Of course, no aerial photographs had been taken at that time, but I said that if they were taken they could be used for mapping, though the photograph would have to be rectified. That, of course, brought in the principle of the rectifying camera. Scheimpflug picked up from my book this idea of a rectifying camera. He went back to Austria, joined the Imperial Geographic Institute there, and made a camera consisting of six lenses, one pointing straight ahead and five pointing sideways. Then he built a rectifying camera just like the one that has been used during the war to rectify the pictures that you have seen here and enable them to be joined together in a mosaic. He undertook to map the vicinity of Vienna. The undertaking was, of course, experimental. I was in correspondence with him, and he sent me copies of his photographs. I got some beautiful maps from him, made from his rectifying photographs; they were just as good as any that were made during the war. These photographs were made from balloons in 1904 or 1905, I believe, and about that time he died. When he died aeroplanes were coming into use, and he had projected a plan of experimenting in the use of the aeroplane for these purposes. His death, however, prevented him from carrying these plans out.

The next man who used aerial photographs was Colonel Theile, a Russian, and a colonel in the Russian army. I was in correspondence with him also. He used to write me in French and send me details of his work in Russian; so it would be too much for me to give the exact details here. These were the first attempts that were made at aerial mapping; I have no doubt that the Scheimpflug equipment was used by the Austrians against us during the war. Anyway, we must give him credit for what he did along these lines.

A man who is now working at the solution of this problem is Dr. Mees. He was here recently and talked the matter over with me; we had a very pleasant day together. Dr. Mees has never undertaken anything that he has not carried out, and I have no doubt that he will find a solution of that problem; I leave it to him.

This concluded the proceedings of the evening session.

FRIDAY MORNING SESSION.

The meeting was called to order at 9.30 o'clock, the President in the Chair.

MR. DODGE: Mr. Chairman,—Before we proceed with the business that is before us I should like to move, if it is in order:

That the Secretary be instructed to write a letter to the Librarian of the Carnegie Library, Mr. Sykes, expressing the thanks of this Association to the library management for the use of the lecture rooms during our meetings.

The motion was seconded by Mr. Rannie, and adopted.

ELECTION OF OFFICERS.

THE CHAIRMAN: The first item of business this morning is the election of officers. The report of the scrutineers shows that 128 ballots were submitted. Of these, 3 had not been signed by the voters and consequently were not opened. One ballot had been returned to the Secretary by the Post Office, unopened. Four ballots were rejected because the voters had struck out the names instead of marking with a cross. On 43 ballots it was found that the voter had voted for councillors for two or more provinces. In such cases the votes for President, Vice-President, Secretary and Councillors for Ottawa were allowed and the votes for Councillors for the Provinces rejected.

As a result of the vote the following have been elected as Officers and Councillors for the ensuing year:

President: F. V. Seibert.

Vice-President: G. H. Blanchet.

Secretary: F. D. Henderson.

Councillors for Ottawa: W. J. Boulton; T. A. McMcElhanney; B. W.

Waugh; W. H. Norrish; F. H. Kitto.

Councillors for Quebec and Maritime Provinces: H. L. Seymour.

Councillors for Ontario: J. W. Pierce; A. L. Cumming.

Councillors for Manitoba: H. E. Beresford; A. R. Neelands.

Councillors for Saskatchewan: J. L. R. Parsons; A. C. Garner-E. H. Phillips, tie.

Councillors for Alberta: R. H. Knight: R. H. Montgomery.

Councillors for British Columbia: N. C. Stewart; J. A. Calder.

A vote by ballot was thereupon taken to decide the tie between A. C. Garner and E. H. Phillips for Councillor for Saskatchewan, as the result of which Mr. Phillips was decided elected.

MR. NORRISH: The majority of the active members of this Association are members of the Surveyor-General's staff. I suppose it is quite natural for them to vote for their own men; but I notice that there is no representative from the Geodetic Survey on this ballot, and I would like to resign in order that a representative of the Geodetic Survey may take my place on the Council

The CHAIRMAN: That is very good of Mr. Norrish. The argument he puts forward is good also; we should certainly have a representative of the Geodetic Survey on the Council. Mr. Norrish's resignation means that Mr. Nelles is elected. (Applause).

MR. NELLES: What Mr. Norrish suggests shows a splendid spirit of co-operation, but I could not think of accepting. Of course, if the Association of Dominion Land Surveyors is to be a representative body it should not confine its Council to members of one branch, that is certain. But so far as I am personally concerned I am not very much interested; I am a member of some other committees and my time will be pretty well taken up.

MR. HERRIOT: I think the majority of the members here would be glad to support a motion for amending the constitution so as to provide that the number of surveyors from the Topographical Surveys Branch who might be chosen as Councillors should not exceed three out of the five. That would give opportunity for the distribution of the other two sets among the remaining branches. Of course, formal notice of motion would be required.

THE CHAIRMAN: It is true that the change could not be made until next year, but the idea is a good one. That would prevent a recurrence of what has happened this year.

MR. NORRISH: Clause 14 of the Constitution provides for the appointment of certain standing Committees, among which is a Geodetic Surveys Committee. If my resignation is not accepted there will be no Chairman for the Geodetic Surveys Committee; or if there is, he will not belong to Geodetic Surveys. I would again request Mr. Nelles, therefore, to accept the Councillorship in my place.

THE CHAIRMAN: I am sure that Mr. Nelles will accept—not that he wishes the office personally, but for the good of the Association.

MR. NELLES: It seems to be the general opinion that I should accept; therefore I do. Every one here must appreciate the worthiness of Mr. Norrish's motive in doing what he has done. (Applause).

MR. SEIBERT: I wish to thank the members of this Association for electing me as its President. I appreciate the honour which you have done me, although I am not unmindful of the fact that in electing me you have also to do honour to the members in the West. Most of those men are personal friends of mine, and speaking for them I thank you again, and assure you that I will do all I can during the ensuing year to further the interests of our Association and, through it, the interests of our profession. (Applause).

THE CHAIRMAN: I assure you that with the honour there is plenty of work and responsibility. Now, we were referring to proposed amendments of the Constitution.

MR. HERRIOT: Without a doubt the question of fees should be taken up at this meeting and, perhaps, a notice of motion submitted so that the matter could be dealt with.

MR. S. D. FAWCETT: With regard to the ballot, I do not think that all the names should be put on a long ballot like that. If a man in a given province were sent a separate ballot for Councillors for that province, together with one for Councillors at Ottawa, the confusion that has arisen would not occur again.

MR. DODGE: Undoubtedly that is the best way to do it, if it were not for the expense.

MR. PALMER: If the warning not to vote in any province but your own was printed in large type at the top of the ballot, there would be less misunderstanding.

MR. DODGE: When the ballots are sent out they could be sent to members by provinces and the Secretary could cancel with a rubber stamp all names except those applying to the province in question.

THE CHAIRMAN: The Secretary will take note of these suggestions and next year's Council can look into them. Some provision should be made for a limitation of the time within which negative votes may be cast in balloting for new members. Three negative votes disqualify a man from becoming a member of our Association, but sometimes replies are not received from more than three, in which case a candidate's admission to membership may be indefinitely postponed. These votes should be in within a specified time.

MR. HENDERSON: I would direct attention to section 45 of the by-laws, which says:

"Proposed amendments to these By-Laws must be reduced to writing, signed by not less than five Active Members, and submitted to the Secretary-Treasurer not later than the first day of December. Proposed amendments to the By-Laws may also be submitted by the Council. The proposed amendments shall be mailed to Active and Junior Members at least thirty days before the Annual General Meeting. Such amendments shall be in order for discussion at the Annual General Meeting, and may be amended in any manner pertinent to the original amendments by a majority vote of the Annual General Meeting, and if so amended, shall be voted upon by letter ballot as amended by the General Meeting; if not so amended, they shall be voted upon by letter ballot as submitted.

The letter ballot shall be returnable to the Secretary-Treasurer not later than three months after the Annual General Meeting. Scrutineers appointed by the Council shall immediately thereafter count the ballots and report the results to the Council.

An affirmative vote of two-thirds of all ballots cast shall be necessary to the adoption of any amendment.

Amendments so adopted shall take effect forthwith except that officers of the Association, at the time any amendments may be adopted, shall continue in office until the next Annual General Meeting."

Except in the election of Councillors, therefore, the procedure, as I see it, is this: the Secretary must be notified not later than the first day of December of any proposed amendments. These are sent out to active and junior members at least thirty days before the annual general meeting. The meeting considers them, the ballots are sent out, and on the return of the ballot if the amendment is carried it goes into effect forthwith.

MR. RANNIE: I move that next year's Council be instructed to arrange for a Committee on Amendments to the by-laws and that any proposed amendments be sent in writing to the members before the first of December next.

The motion was seconded by Mr. Shaver and adopted.

MR. HERRIOT: Before we go on with any further business I would like to draw attention to the fact that Grant,-Holden,-Graham, Ltd., went to a good deal of trouble in putting up the tent on the stage at the Collegiate Institute Hall on the occasion of the lecture there on Wednesday evening. They sent a delivery rig over with it, put it up, and afterwards called and took it away. I move that the Secretary be instructed to send a letter of thanks to them, signifying our appreciation of their kindness.

The motion was seconded by Mr. Rannie and adopted.

THE CHAIRMAN: We are now ready to hear the report of the Committee which was named to consider the question of the proposed formation of a Canadian Institute of Surveyors.

MR. SEIBERT: The committee on the proposed formation of a Canadian Institute of Surveyors beg to submit the following as their report:

"It is recommended that the incoming Executive immediately appoint a committee from among its members to get in touch with the other Associations of Surveyors in Canada, and in conference with them lay down the principles upon which the proposed Institute is to be based and the objects for which it is to stand; and to help draft a constitution, rules and by-laws and to bring it into being as one more factor in the co-operation of men to help their fellows.

It is here stated that in the opinion of this committee, the profession of the Surveyor is the highest, the most honourable, and the oldest profession in the world to-day, having for its foundation mathematics, and embracing within its scope the parts of this science which have now become specialized by its different members, such as, astronomy, navigation, geology, exploring, etc.; its mathematics being applied to physical material it undertakes the laying out and constructing of roads, railroads, canals, bridges and many other so-called engineering works.

That branch of the surveyor's work that deals with the fixing of land boundaries, is the basic principle upon which our civilization of to-day rests. No matter what wealth a man may possess or in what form it may be, if it is traced back far enough it is at last defined by the land boundaries set by the surveyor.

The men who have done and are doing really big things in Canada were and are Surveyors, such as, the man who built the St. Clair tunnel, the men who built the Canadian Pacific Railroad, the Chairman of the International Joint Commission, the Fuel Controller, the Chief Engineer of the Railroad Commission, the Deputy Head of the Conservation Commission and many others. The present Governor of Alaska is a surveyor. Those intrepid explorers, Amundsen, Scott, and Christopher Columbus we also claim in our ranks.

Some 50,000 years ago our ancient professional brothers, who in those days were called "wise men", surveyed and built the Great Pyramid of Medum in Egypt, the largest and oldest building in the world to-day. They not alone knew how to build, but their knowledge of surveying and geology was so great that they were able to place it upon a piece of ground that from that time to to-day has not been affected by an earthquake.

And lastly, we are Commissioned Officers whose time is for the greater part spent upon active service in the field for our fellow man who is symbolized by the King from whom we receive our Commission."

(Signed) FRED. V. SEIBERT,
J. W. PIERCE,
DOUGLAS H. NELLES,
Members of Committee.

MR. PIERCE: I beg to move the following resolution, which practically in the words of that to which reference was made the first day of our meeting:

1. That in the opinion of this Association it is desirable in the interests of our profession that a Dominion-wide Association of land surveyors be formed for the purpose of better protecting and advancing its interests and promoting its good and welfare.
2. That a committee of three of this Association be appointed by the Executive to enter into communication with the various surveyors' Associations throughout Canada for the purpose of organizing such Association.
3. That the said committee be empowered to do all acts necessary to advance the formation of such Association, with power in connection with a committee from all or some of the other As-

sociations to call a general meeting of surveyors for the purpose of organizing a Canadian Association.

4. That the Secretary of this Association be the Secretary of the said committee.

MR. SEIBERT: I second the motion.

MR. NORRISH: Is any provision made for the appointment of the other two members of the committee?

MR. RANNIE: In accordance with the principle which prompted Mr. Norrish's resignation from the Council for Ottawa, I suggest that the committee of three be as representative of the Dominion Land Surveyors' Association as possible. Remember also that right here in Ottawa there are a lot of surveyors in other branches—in the Reclamation Service, the Water Powers Branch, and in many other branches, and in the Interior and other Departments as well. That committee is none too large.

MR. HERRIOT: It should be increased to five.

MR. DODGE: I take it that this committee of three will confer with similar committees from the other Associations. In that case it would not be wise to make the committee any larger.

MR. McELHANNEY: Our position is different from that of Provincial Associations because all their members are on the same footing, whereas our members come from many different departments. We might, therefore, achieve better results by increasing the number on our committee so as to make it more representative.

MR. STEWART: There would be no objection to your making the committee just as large as you wish, and just as representative as you want it to be. But one objection to large committees is that each member says: "Let George do it"—no one accepts responsibility; no one does the work. If you have a small committee they usually get down to business.

MR. SEIBERT: There seems to be a difference of opinion on this point. Let someone move that the committee consist of five members; then we shall have an expression of opinion on it.

MR. McELHANNEY: To get this before the meeting I move:

> That the committee of this Association to be appointed by the Executive under paragraph 2 of the resolution consist of five members.

The amendment was seconded by Mr. Rannie and adopted, and the motion as amended was adopted.

CLASSIFICATION AND REMUNERATION

THE CHAIRMAN: We will now have the report of the committee of which Mr. Hawkins is chairman.

Mr. Hawkins submitted the report of the committee as follows, and moved its adoption:

"Your Committee beg to report their entire sympathy with the question of increased remuneration for Surveyors in particular and all classes of technical work in general.

The fact that the Civil Service Commission advertises positions at salaries of from $1200 to $1500 per annum and sets out the qualifications as requiring a D.L.S., is viewed with extreme dissatisfaction and alarm as it shews most plainly that the Commission are not in possession of the facts concerning the requirements and training necessary to secure commissions as Dominion Land Surveyors.

It is recommended that the incoming Council be asked to appoint a committee, giving them instructions and authority to deal with the matter, to confer with similar committees from sister organizations throughout the country, obtain such influence as is possible through members of the House of Commons, and in conjunction with other technical societies, register a strong protest pointing out the injustice to men performing very necessary technical work and suggesting such constructive legislation as will tend to improve the service and remunerate the men fairly.

People should be encouraged to take what education they may be able to acquire, and not as seems to be the Commission's policy, penalize the acquiring of education."

(Signed) A. H. HAWKINS,
W. J. BOULTON,
R. F. CLARKE,
Members of Committee.

MR. BOULTON: I second the motion that the report be adopted.

MR. NORRISH: The question is whether we should boost the salaries of technical employees of the Government generally, or simply of Dominion Land Surveyors. The Engineering Institute have for a long time been endeavouring to secure an increase in technical salaries, and the Dominion Land Surveyors' Association have been aiding them in that movement. I would like to hear the question discussed whether we could not better help them and help ourselves now by boosting the salaries of Dominion Land Surveyors.

THE CHAIRMAN: There is no doubt that in anything we do in the matter we shall have the support of all surveyors in all the provinces. As Mr. Stewart pointed out, the provinces look to what has been done in the Dominion, and if they wish to secure an increased remuneration for themselves they say: "You see what the Dominion Government are giving their surveyors." So if we improve our own standing we improve theirs also.

MR. NORRISH: We are technical men, and if we boost our salaries the result will be bound to reflect in the salaries of engineers. Besides, we give the members of the Provincial Land Surveyors' Associations something more definite to work on. They have approached their Provincial representatives with regard to increases. If they approach them for a general increase in technical salaries they are tackling the general problem again and probably their efforts will have little effect.

MR. MILLIKEN: Before commencing this work I was engaged in a different line for a number of years and I thus had an opportunity of knowing the mind of the people—I mean the people throughout the country, not in centres like Ottawa. Here, where lectures are delivered by different societies, such as the Astronomical Society, the people get a fair idea of the status of surveyors. But the people throughout the country make a distinction between different professions. They look upon law, medicine and some of the other professions as higher than engineering. That is possibly because they do not understand that the qualifications required of an engineer are as high as those required in the professions mentioned; in fact, the qualifications of a number of our surveyors and engineers are possibly much higher than those of large numbers who are engaged in the practice of law and of medicine. The trouble is that the public do not know this. What machinery is there for properly acquainting the public of the facts in regard to our profession ? We have none· Surveyors have been in the field; they have been engaged in the work; they have not boosted themselves. With the exception, as I have said, of the people living in Ottawa and a few others, the general public do not know the circumstances, they make distinctions even between civil engineers and surveyors. Things are changed now; those who have been land surveyors are largely doing civil engineering work. The qualifications of a surveyor are much higher than they were in the old days. The general public get their idea of what a surveyor is from the conditions in the old days, when anybody who went out in the field for a couple of years was called a surveyor; they do not know what the qualifications of a surveyor are at the present time. Nor do they know that many surveyors are qualified as civil engineers, and that the majority of them have qualifications just as high as those of civil engineers. Why, then, make the distinction between civil engineers and surveyors ?

MR. McELHANNEY: I was walking home with Mr. Wallin the other evening and he drew my attention to the conditions in Sweden. He said that there the salaries of labourers had increased 250 per cent since the war and the cost of living 160 per cent, while the salaries of professional men had increased 150 per cent. That is, while the labourers were in a better condition now than they were before the war, their remuneration having increased in greater proportion than the increase in the cost of living, the professional men had not quite kept up to the increased cost of living; they were just 10 per cent behind.

I have regretted that Mr. Dill's paper on the Development and Improvement of Saskatchewan Highways had to be so abruptly cut off on account of the lack of time. There was one point in connection with that paper that I had intended to bring out—that is, with regard to the organization of the Highways Department· Too much distinction has been made between engineering and surveying. In the organization of the Highways Department you will see that the Surveys Branch or Division is part of the Engineering Branch, and the attitude of the Department towards surveyors is quite different from the general attitude of engineers towards surveyors. The Department look upon their surveyors as being of the same status as engineers. In fact, the general attitude of the Department towards surveyors is very highly to be commended.

MR. STEWART: I think their attitude is shown by their salaries more than in any other way. $2400 a year is very low.

MR. NORRISH: I think Mr. Stewart has hit the keynote again. We can point out more effectively to members of Parliament and others who are influential with the Government the inadequacies of salaries paid to the members of the surveying profession than we can the general inadequacy of technical salaries. It seems to me that we could take it up from the Provincial as well as from the Dominion standpoint and boost the thing from the surveyors' standpoint generally. There is no doubt that that would also help the general campaign on behalf of higher salaries for technical employees.

MR. BOULTON: The report recommends that the committee confer with similar committees from other organizations before they put in their final recommendations.

MR. PALMER: After the luncheon yesterday it seemed to me to be a case now of either putting up or shutting up. The Association should go on record very strongly in regard to this matter. Dr. Roche told us yesterday that our making representations would not do us any harm; so I think we ought to go at it in earnest.

MR. SEIBERT: I think that the majority here are in favour of some definite action, and particularly with regard to Dominion land surveyors. The Dominion land surveyors follow a somewhat different occupation from the members of any other branch of the engineering profession. Twenty-five years of the life that we lead causes us to be unable to attempt any other kind of work, and the Department does not give us assurance of work after that time. We have good arguments that should be presented to the Civil Service Commission, and we are lax in our duty to ourselves and to the members of our profession who are not here if we do not make the very strongest representations that we can for the information of the Commission. It has been said by some that the Surveyor-General might not wish to back us up in that at the present time. I think that we have been leaving it entirely too much to the Surveyor-General. We have not been giving him the support that we should. I believe that the Surveyor-General is wholeheartedly behind us; his actions have borne that out. This motion does not tie us down to co-operation with any other society; that is, we can go right ahead ourselves.

MR. HAWKINS: There is all manner of evidence to show that surveyors and technical men generally are not being paid as they should be. Plumbers are getting a dollar an hour; labourers doing ordinary day work are getting from five to seven dollars a day. There is not much room, therefore, for argument in the matter. The meeting should adopt this resolution and put it up to the new Council to form a committee at once and have them get to work.

MR. HERRIOT: We ought to give this committee a mandate to make their representations as strong as they possibly can. I would urge that the new Council appoint the committee as soon as they can and that the committee have the consent and agreement of all the members here to make their plea for increased remuneration as strong as they possibly can.

MR. SEIBERT: We are not working selfishly in this matter. The profession is going to go down if the present scale of remuneration is continued. I have letters on my files from two D. L. S. men who are going to enter other professions. They are young men and can get out; some of us are older and cannot get out. I may say that I also have an offer of better remuneration from a private corporation than I am getting to-day out of the practice of my profession. I have every hope in the future; but we have to get to work. We do not want anything to lower the standard of our profession; we do not want to have in our ranks men who are not qualified. If something is not done everything will suffer—the profession itself, the departments of the public service, and the public at large.

The motion of Mr. Hawkins for the adoption of the report of the committee was carried unanimously.

THE CHAIRMAN: Is there any other new business, gentlemen ?

MR. PIERCE : Under our constitution as it stands it is possible for a member to vote for sometime after he has stopped paying his fees. The Ontario Land Surveyors' Association have a method of getting over this which I think we might consider. When the ballot paper is sent out, the envelope in which it is to be returned to the Secretary is marked on the outside with the man's name and the signing of the Secretary's name thereto certifies that his fees have been paid for that year. The ballot is no good unless that certificate is on the envelope, and the Secretary is thus relieved of a lot of trouble in connection with fees.

MR. HENDERSON: I do not know whether Mr. Pierce had any particular members in view when he made his remarks. But I would like to draw the attention of the meeting to a condition of affairs which will, perhaps, be remedied when mention is made of it. I refer to the case of the returned soldier. About sixty of our members went overseas, where they conducted themselves with distinction. Now the war is over and they have come back. Some of them have again taken up their duties as members of this Association, one of those duties being the payment of fees. Others have come back, entered into civil life, and do not seem to realize that an Association of this kind has to have money for current expenses. I merely throw out this suggestion so that it will go on record; perhaps that is all that will be needed to cause those men who wish to come back into the Association to pay their fees. A motion was adopted early in the war that the soldier members of our Association should be carried without payment of fees during the war. That was perfectly right, but the war is over now, and it seems to me that some time should be fixed within which those who have returned should pay their fees, and that if they do not come forward with their fees within that time they should be dropped from the rolls of the Association. I may say that in the case of returned men who wanted to get into the Association again, I took it upon myself to start them whenever they felt like starting; I did not ask them when they got back or anything about it. But I think that some such definite action should be taken as I have suggested.

MR. CLARKE: Mr. Henderson asked me if I would bring this matter to the attention of the Association and I regret that I overlooked doing so. I think it is purely a matter of oversight on the part of many returned men who are still interested in the Association but who have not paid their fees. The kindness of the Association in not holding us to the payment of fees during the time that we were in the army was undoubtedly appreciated, but upon return to civil life I agree that we should be on the same basis as anybody else so far as fees are concerned. During the time that we were in the army we did not, of course, enjoy the benefits of the Association, and that was a reason why we might well be excused from paying our fees—in addition to the fact that we were not very much in a position to pay them, anyway. But all these things have changed now, and I think it is merely a question of putting it up to those men who were overseas to ensure the payment of the fee. Some men who have come back may be no longer interested in the Association, and if they do not want to retain their connection with it, it is only right that they should be dropped.

MR. HENDERSON: Clause 31 of the by-laws provides as follows:

> Any member whose dues are more than twelve months in arrears shall be notified by the Secretary-Treasurer. Should his dues become eighteen months in arrears, he shall again be notified in form prescribed by the Council, and he shall lose his right to hold office, to vote and to receive the publications of the Association. If such dues become two years in arrears, he shall forfeit his connection with the Association, and his name shall be struck from the rolls.

Now, at what date are we to consider that the returned soldier begins to be in arrears?

MR. SHAVER: A fair time should be the date of the signing of peace. That happened just about the end of our year.

MR. NELLES: As a returned soldier, I think that is fair.

MR. DODGE : I suggest that by-law 30, so far as it refers to returned soldiers, should become effective from the month of January, 1920.

MR. NELLES : Mr. Stewart points out that clause 31 covers that.

MR. PALMER : What about the returned soldier who is incapacitated from practising his profession but is still interested in the Association? Would he become an honorary member ?

THE CHAIRMAN : Not an honorary member; he might become a life member.

MR. DODGE : There is no provision for life members in the by-laws.

THE CHAIRMAN: They can be perpetually considered by Council as individual cases.

MR. HENDERSON: Of course, we are speaking now not of individuals, but of a class. I think Mr. Dodge has the right idea.

MR. DODGE : I move :

> "That by-law 31, so far as it applies to returned soldiers, have reference to the first day of January, 1920, and that the question of returned soldiers who have been incapacitated for further work be given consideration."

MR. FREDETTE : I second the motion.

MR. STEWART : I do not see the necessity for this motion. Clause 31 provides that the Council may in individual cases extend the time for payment and for the application of the penalties mentioned therein. Some returned soldiers may be in the S. C. R., some may be in hospital; some who are in Canada may not be demobilized. There should not be more than four or five of these cases altogether; let Council deal with them. It is rather drastic to say we are going to put them out of the Association on the first of January if their fees are not paid within a certain time. There may be some extenuating circumstances.

MR. DODGE : I do not think that Mr. Stewart caught the spirit of my motion; it is the application of a general rule. Under clause 31, of course, Council can always make exceptions.

MR. STEWART : Clause 31 itself provides the general rule; it also provides for exceptions.

MR. DODGE : The point before us now is, when do the fees of returned soldiers become in arrears ? I would be a little more candid than Mr. Henderson has been. Some returned soldiers have been back since 1916 or 1917 and have shown no inclination whatever to pay their fees; they have been carried right along because they are returned soldiers. Why not specify a certain date in connection with the application of this clause, so that we shall know where we stand ?

MR. NORRISH: As I understand Mr. Dodge's motion, no returned soldier can be dropped until the middle of 1921; that is, until he is eighteen months in arrears. I think that is quite fair.

The motion was adopted.

NOTICES OF MOTION.

THE CHAIRMAN read the following Notices of Motion for the next annual meeting:

> Notince is hereby given that at the next Annual Meeting I propose to move that the retiring President of this Association automatically become a member of the incoming Council.
>
> W. J. BOULTON,
> G. H. HERRIOT,
> J. L. RANNIE,
> P. E. PALMER,
> R. C. PURSER,
> P. M. H. LEBLANC,
> D. H. NELLES.
>
> Notice is hereby given that at the next Annual Meeting I propose to move that the fees of this Association be increased to $5 for resident and $3 for non-resident members.
>
> J. W. PIERCE,
> FRED V. SEIBERT,
> A. H. HAWKINS,
> G. H. BLANCHET,
> G. H. HERRIOT.
>
> Notice is hereby given that at the next Annual Meeting I propose to move that the Council of Ottawa shall consist of not more than three members chosen from the Topographical Surveys Branch, the remaining members being chosen from the other members of the Association making their homes in Ottawa—or words to this purpose.
>
> G. H. HERRIOT,
> J. L. RANNIE,
> W. J. BOULTON,
> F. V. SEIBERT,
> J. W. PIERCE.

MR. NELLES: I move that the Secretary be instructed to write to the Association of Alberta Land Surveyors expressing the appreciation of this Association for their spirit of co-operation in sending Mr. Stewart down here and for the resolutions which he brought with him and which have assisted us greatly in our work. (Applause).

The motion was seconded by Mr. Pierce and carried unanimously.

MR. HERRIOT: Ontario is taking steps towards making resurveys and carrying out reposting throughout the province; in fact, they have had over

3,000 posts made. I think the time is opportune when the Dominion, in co-operation with the provinces, might reasonably institute a general policy of resurveys and reposting—not a policy of carrying on isolated operations here and there as the demand calls for them, but a general policy which would be pursued uniformly throughout. Manitoba, I know, would be only too glad to co-operate with the Dominion in instituting and organizing such a system of reposting, re-establishment of monuments, and resurveys where necessary. The Land Titles Office in Winnipeg had hoped to make a beginning in this work last spring, but labour conditions were too unfavourable. They had planned to send surveyors out among the old settlement lots along the river to make re-establishments of posts that were still in evidence; where they could find traces of old posts they were to renew them and put in iron posts. That is only a beginning, but there is no doubt that if the Topographical Surveys Branch made a step in that direction, the co-operation of the provinces would be secured. Every surveyor who has ever done any resurvey work knows that these operations are more extensive and more complicated and call for more ingenuity on the part of the surveyors than was the case with the original survey. I do not suggest that we should tackle the whole thing at once, but I suggest that we instruct the Land Surveys Committee to take this matter up as one of their first problems; in fact, I put that in the form of a motion. Questions of wage and remuneration are closely connected with the conditions of supply and demand. When labour is plentiful, wages are low; when labour is scarce, wages are high. So with surveying. If there is a small field for work and many men willing to undertake that work, the wages cannot be expected to rise. If we can find a field for work; if we can extend the scope of our activities, we can more reasonably demand increased remuneration.

MR. NORRISH: I would like to see some way of getting Mr. Lonergan on this committee, and, if possible, Mr. Narraway also. Mr. Lonergan busied himself in Edmonton last summer trying to get Alberta to make a start with these resurveys. If there is some provision under which the Land Surveys Committee could add to their numbers, it would be quite all right to have them handle the matter, I should think.

MR. STEWART: I assure you that the Alberta Land Surveyors are hoping that something will be done in this regard. They are talking about a resurvey of the province. This Association might get in touch with the Alberta Land Surveyors Association; the committees of the different Associations might work together very profitably.

MR. PALMER: A resurvey in Saskatchewan would seem to be necessary. Mr. Weekes, of the Highways Branch, stated to me last year that they were in favour of a resurvey in certain districts where the monuments had been lost.

MR. SEIBERT: Something has been said about the work that would be involved in these operations. I think that we all have in mind chiefly the service which would be rendered to the public at large through these surveys. It is almost a necessity that this work be gone on with; it is certainly a matter of sound business policy to advocate it—not for ourselves alone, but for the good of the lands and the people resident thereon.

MR. PALMER: I second Mr. Herriot's motion.

The motion was adopted.

REPORTS OF COMMITTEES.

Topographical Surveys Committee.

MR. BLANCHET submitted the report of the Topographical Surveys Committee, and moved its adoption:

The motion was seconded by Mr. Boulton and carried.

The Dominion Land Surveys Committee Report was included in the Report of the Topographical Surveys Committee.

Geodetic Surveys Committee.

MR. NELLES: Mr. Rannie was unable to remain, and asked me to state that the Geodetic Surveys Committee has no Report to bring in, as no work had been undertaken which had not been already reported on.

Publication and Publicity—Town Planning.

The Reports of these committees were presented by Mr. Hawkins and adopted as read.

Report of Committee on Town Planning.

Your Committee after considerable deliberation has decided that this report might be most useful if made in the form of suggestions to surveyors.

The first suggestion is that all surveyors should develop or retain an interest in town planning. It is probably not necessary to remind the members that through the efforts of a Committee of this Association, the recently formed Town Planning Institute came into being. Many surveyors have joined this Institute. To others we urge an interest in at least a local way. Take some thought of your home town, of its planning problems and how you can help as a leader in public opinion, if not in a strictly professional way.

We wish to point out that though Provincial land surveys can only be carried out by Provincial Land Surveyors, surveys in the broad sense are in the province of the Dominion Land Surveyor as well as of the Provincial Land Surveyor. If any surveyor is to restrict his interest in town planning to the mere staking out of lot and street lines, he will have passed up his opportunity for, and his obvious part in, development and planning for the future.

The collection of maps and data as to distribution of population and buildings, transportation and industrial situations, assessment and taxation, public utilities, parks, schools, etc., and especially the preparation of topographical maps and the studying of such maps and data for the purpose of planning future development, are duties for which surveyors should be fitted by training and inclination, and are duties not limited to any one class by legal enactment.

From the foregoing it may be gathered that no longer should the surveyor think only in terms of land subdivision ,but rather in terms of land development. The questions to be answered are not how much will it cost to make a survey of a lot or lots, but how much would it cost to develop a certain area with buildings and finished streets and other public utilities with the necessary parks and open spaces, Some idea of this cost must be acquired by the surveyor to plan and carry out his part of the work intelligently. Costs of utilities and improvements may be desired in terms of acreage, per foot front or per family.

The above is a development of suggestions kindly made by Dr. E. Deville, Surveyor-General. In brief, it is to take an interest in planning, particularly in your home town, and make your problems a matter of discussion in future Dominion Land Surveyors' meetings.

To those Dominion Land Surveyors who spend most of their time in Government surveys, and find their time and activities in their home town much limited on that account, we suggest that Regional Planning and Development should be made a study. Land classification as now being carried out involves essentially the idea of development as opposed to mere subdivision carried out in the past. And so, too, is the idea of intelligent development involved in the making of topographical surveys. From the surveyor there should be expected, not stereotyped forms of rural development, but a scientific formulation of general underlying principles that could be applied to particular situations.

As a general study for this Association we suggest the subject of "Regional Planning", for which, of course, topographical maps are necessary. For any area the data in regard to the following matters might be gathered:

Area and Population;
Railway Transportation;
Highway Transportation;
Nature of the Soil and Surface;
Use and Development of the Land;
Building Development;
Industrial Development;
Water Supply and Sewage Disposal;
Power Developments.

Where areas have been developed to any considerable extent it is felt that the collection or mapping of such data will go far towards making possible the intelligent planning of the area.

Respectfully submitted,

A. H. HAWKINS,
Chairman.

Historical and Biographical Committee.

MR. CLARKE presented the Report of the Historical and Biographical Committee. He said:

I think it was rather a mistake to appoint older members of the Association on this committee. The idea, of course, was that they are more familiar with the past work and experience of the committee. But the operations of an historical committee involve a great deal of work, and older members have not the time or the inclination to follow up historical investigations. It would be much more to the point to assign younger members to the committee, men who are interested and who have the time to spare. The older members can, of course, give them assistance, whether they are members of the committee or not.

Report of the Committee on History and Biography

Owing to its composition and the nature of the subjects to be considered, this Committee did not hold any regular meetings. However, by consultation and correspondence, we first tried to decide upon a policy to be followed by the Committee this year, and at the same time, a policy broad enough to be followed with some continuity by succeeding committees.

The development of surveys in the West naturally falls into two major divisions, between which the nature of the work differed broadly. The first division covers that period from the first discovery of the North West up until the Hudson's Bay Company surrendered to Canada all its claims to territorial rights in that part of the continent. During this period the development was in the nature of discoveries, explorations and purely geographical surveys.

The second division covers the subsequent period. It begins with the mission of Col. J. S. Dennis to the Red River District in 1869, which really marked the inception of Dominion Land Surveys.

We are deeply interested as an Association in two aspects of the work carried on in these two periods. First, we should understand more fully the explorations and surveys which were made. Secondly, we would profit greatly by becoming more familiar with the men who performed this work, the hardy pioneers who blazed the trail along which we have followed.

It was felt by the Committee that it would be wise to first obtain a background upon which future work might be laid. In other words, we decided to first make an outline or skeleton to show the progress of events in their proper sequence and proportion. This was done with the idea that in future years more elaborate and detailed investigations regarding certain surveys and the men who performed them, might be made, and shown in their true position by the outline.

This policy has been applied to the earlier period. With the later period, it was not so readily applicable, nor so necessary. Instead, for the later period, Mr. R. C. Purser, D.L.S., has prepared a sketch of the history of the Dominion Land Surveyors' Association from the time it was first formed in

1882 up until 1894 when this first Association died a natural death from lack of support. The Association in its present form was not reorganized until about 1906.

The earlier period of exploration and surveys in the West has been covered by an outline prepared by the convenor of the Committee.

Your Committee has also obtained brief biographical sketches of the two members of the Association whose regretted death occurred during the past year, Mr. J. E. Sirois and Mr. W. A. Scott. If any members of the Association, who were familiar with either of these late confreres, know of any features of interest concerning their lives, not mentioned in these notes, the Committee would be very glad to incorporate such items with the information in hand.

Before closing this report, your Committee begs permission to make some suggestions for the consideration both of the committees who are to succeed us, and of the Association as a whole.

These suggestions may be summarized as follows:—

1. The work prepared this year points the way to further investigations, particularly of a biographical nature which would be of intense interest to the Association. In the earlier period there are numerous explorers whose biographies apparently have never been written. There are also the surveyors connected with the Red River Settlement,—Fidler, Kempt, Taylor, Sabine, Goulet, and others,—of whose lives a more full account than any we have, would be both interesting and instructive. For this purpose, it would seem wise to have as members of the Committee, one or two residents of Manitoba or Saskatchewan Universities. Then there are all the early Dominion Land Surveyors proper, the men who commenced the surveys around the Red River in 1870, and the men who formed the Association in 1882. The inspiration of the character of many of these men and the work they performed will be forever lost unless something is done to preserve their record in at least brief biographies. We might follow the example successfully set by the Ontario Land Surveyors in this respect with great profit to ourselves. It would add much interest to these biographies if photographs could be obtained in as many cases as possible.

2. A good deal of consideration has been given to the subject of establishing a small library under the secretary's care for the benefit of members. There are many objections to attempting to do this, the chief being the serious limitation of funds available to the Association for the purpose of establishing such a library and that if it were established, it would serve only a small proportion of the total membership of the Association. However, it is felt that a very profitable beginning at least might be made along these lines by carefully preserving the back files of the Proceedings of the Annual Meetings for future reference, and by collecting through exchange, similar files of the proceedings of not only the various Provincial Land Surveyors' Associations but of similar organizations in such countries as the United States, Australia, etc. Similarly, papers delivered before special meetings of the

Association, or courses of lectures of special interest to members, such as Mr. W. A. Johnston's lectures on "Soils", together with the text books used, should be preserved in as complete a form as possible. For the proper preservation of these valuable records, they should be properly bound and deposited with the secretary for the general use of members of the Association.

3. A work of considerable value to all members would be the preparation of a complete general index for the contents of all D.L.S. Reports to date. This undertaking might reasonably be allotted to the Committee on History and Biography.

As already explained, the following subjects are herewith presented by your Committee:

On Biography—

1. Mr. J. E. Sirois, D.L.S., Q.L.S.
2. Mr. W. A. Scott, B.A.Sc., D.L.S.

On History—

1. The History of the Early Formation of the Dominion Land Surveyors' Association.
2. An Outline of Early Explorations and Surveys in the Canadian North West.

(Signed) R. F. CLARKE,
Chairman of Committee.

Biography—

J. E. Sirois, D.L.S., Q.L.S.

Joseph Eustache Sirois was born on the 19th of September, 1858, at Ste. Anne de la Pocatière, County of Kamouraska, Prov. of Quebec.

He was educated at the Collège de Ste. Anne and, on the completion of his term, deciding to follow the profession of Engineering and Land Surveying, he was admitted Quebec Land Surveyor the 15th of April, 1882, his Dominion Commission being obtained the same year.

Mr. Sirois in beginning his professional career was engaged in township subdivision surveys in the part of our Dominion then called the North-West Territories, but soon afterwards devoted all of his attention to the Provincial field, where he was entrusted with the execution of important work for the Provincial authorities and Incorporated Companies, as well as being District Engineer for the Dominion Public Works Department.

In addition he has been elected a member of the Board of Directors of the Surveyors of Quebec at every successive election since 1883, and has been its President since 1912.

Mr. Sirois died at Ste. Anne on the 10th of October, 1919, leaving a wife and several sons and daughters to mourn his loss.

Biography—

W. A. Scott, B.A.Sc., D.L.S.

Walter Alexander, the youngest son of William and the late Annie Scott, was born in Galt, Ontario, on the 8th of August, 1885. He had received his early education at the Galt Public Schools and Collegiate Institute. He went on to the School of Practical Science in Toronto, from which he graduated with honors, in 1906. After thus obtaining his diploma in Civil Engineering, he spent a year and a half on the National Transcontinental Railway. He returned to the University again and was granted the degree of B.A.Sc. with honours in 1908. The following year he wrote off the final D.L.S. examination and received an appointment in charge of a party. In 1912, he obtained commissions as a Land Surveyor in both the provinces of Saskatchewan and Alberta, and started in private practice in Calgary, remaining there for three years. In 1915, he returned to the work on Dominion Lands.

Like so many other surveyors, Mr. Scott felt the call to sterner work in the battle line overseas. He enlisted in Toronto in February, 1917, joining the 256th Battalion, which afterwards became the 10th Canadian Railway Troops. They were hurried through their course of training to such an extent that by June they had passed through their period of training in England and reached France. Mr. Scott was awarded the Military Medal for his gallant and efficient work in the battle of Paschendaele. Immediately after that, in October, 1918, he was taken ill with tubercular peritonitis, from which he never fully recovered. After spending some time in the hospitals in England, he arrived home January 30th, 1919, and shortly afterwards received his discharge.

Last spring he again obtained work on the field staff of the surveys. While out on the work he developed appendicitis. He was operated upon on August 8th and appeared to be doing quite well for a few days. But the trouble he had contracted on active service had undermined his strength, so that he was not able to rally from the strain of the operation. He died on the 12th of August, 1919.

His body was brought back to Galt and interred in Mount View Cemetery.

Mr. Scott was unmarried. A very sad feature of his sudden death was that all arrangements had been made for his marriage as soon as he returned from the field in the autumn.

In religion Mr. Scott was a Methodist.

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W. A. Scott, B.A.Sc., D.L.S.

HISTORY OF THE EARLY FORMATION OF THE DOMINION LAND SURVEYORS' ASSOCIATION

—BY—

R. C. PURSER, D.L.S.

In the spring of 1882 a number of surveyors engaged by the Department of the Interior on their way to their season's work in the Canadian North-West were forced to remain over in the city of Winnipeg—then only a small town—for several weeks, their supplies having been delayed by severe floods along the Red River valley.

On the evening of Saturday, April 22nd, 1882, about thirty of these surveyors met for the purpose of discussing certain matters in connection with the status of their profession and their relation to the Government. Otto J. Klotz (now Dr. Klotz, Director of the Dominion Observatory) was elected chairman of the meeting. After some discussion a committee was appointed to draft a memorial to the Government embodying some of the matters under consideration.

On Monday, April 24th, 1882, a draft of this memorial was laid before the surveyors, who approved thereof, and all signed it. It was then proposed to form an Association to further the mutual interests of Dominion Land Surveyors and to meet in Ottawa during the following winter. Otto J. Klotz, temporary chairman, was unanimously elected president and A. F. Cotton, Secretary-Treasurer. A fund for current expenses was formed at two dollars per man. With regard to the memorial it was later forwarded to the Minister of the Interior but no reply was made. No reply could have been expected as they were not an organized body and there was no one especially to whom a reply was due.

No printed proceedings of these Winnipeg meetings were made and no official list of the surveyors who attended is at hand. A partial list is appended to this report.

In accordance with the will of this Winnipeg gathering a meeting of surveyors was held in Ottawa on February 20th, 1883. About sixteen Dominion Land Surveyors were present. It was at this meeting that the name "Dominion Land Surveyors' Association" was proposed and adopted. The printed proceedings, however, issued for the first time, were entitled "Proceedings of the Meeting of Dominion Land Surveyors, engaged on Township Outline and Block Surveys." The advisability of forming an association, its objects and other matters in this connection were deliberated upon at great length. One question that came up was whether or not all Dominion Land Surveyors should be eligible. In answer to this it was decided to make it all embracing and not restricted to those engaged in any particular branch of the work. A primary object of the Association was, in the words of the President, "to further our knowledge in the profession by having papers read and discussed at the meetings, so that each year will find us better able to do our work." Included in the President's address was a detailed exposition of the methods of the different surveys carried on by the United States Government. One interesting point mentioned was that the first recorded use of the terms "township" and "section" appeared to be in an ordinance reported to Congress in 1785.

At this meeting no papers of general interest to Dominion Land Surveyors, excepting the President's address, were read. From thence on, the Annual meetings were held in Ottawa.

As far as we are aware, the Dominion Association, as first organized, was the first society of its kind in America. Similar organizations came into existence soon afterward in several of the United States, and the provinces in our own Dominion quickly followed the example; first Quebec, then Ontario, Manitoba, British Columbia, and recently the newer provinces of Saskatchewan and Alberta. The provincial organizations attained a legal status, controlling the examinations for admission to practice in their respective provinces, and in other ways obtained much power and influence not enjoyed by the parent association.

What is given in the printed proceedings as "The First Annual Meeting of the Association of Dominion Land Surveyors" was held in Ottawa, February 19 and 20, 1884, with 38 members present. Since the membership list at that time contained the names of 63 ordinary members and 11 honorary members it will be seen that the first annual meeting of our association was fairly well attended. Two papers were read, one by the President on the subject of "Projections" and the other by William Ogilvie on "The Relative Value between Ordinary Chaining and Absolute Distance."

The Association was now well started. The second annual meeting extended over a period of four days from February 17th, to 20th, 1885, with 28 regular members in attendance. The membership list given in the printed report of this meeting contained the names of 80 regular and 3 honorary members, including one from New Brunswick, two from Alberta, a number from Winnipeg and other parts of Manitoba, the majority being from the provinces of Ontario and Quebec. Four different papers were read, exclusive of the President's address.

At the third annual meeting, February 16 and 17, 1886, Thomas Fawcett was elected President. The retiring President's address contains such an illuminating commentary upon conditions affecting the profession at that time that I take the liberty of quoting it at considerable length. It follows:—

"Reviewing the events and incidents of the busy world during the past year since we last met, the one touching our profession most was the Rebellion in the North-West, but which happily was soon quelled. Among those who sacrificed their blood for their country was Alexander W. Kippen, D.L.S. from Perth, a promising young man who, scarce a year held his commission, when in the very bud of development he was cut down at Batoche. Besides the one death, several of our members were wounded while gallantly defending their country and the homes of fellow-countrymen, but I am glad to believe that none of the wounds were of a serious nature.

"In 1875 we had a tract of country north of the 49th parallel nearly one thousand miles long and three hundred miles wide scarcely known and but slightly trodden by the foot of the surveyor. In that year were subdivided 30 townships and 1,020 miles of block work done.

"In 1880 the surveys had risen to the subdivision of 194 townships and a total mileage of 14,638. But it remained for the year 1883 to give us the grand record of 1,221 townships subdivided, 1,360 outlined, and a total mileage of lines surveyed of 81,300 miles, a length sufficient to encircle our globe more than three times, and covering an area in which we could drown many of the kingdoms of Europe. During this year there were 119 parties in the field, making a small army of 1,200 men and nearly as many horses.

"Never before in the history of any government have such extensive land surveys been prosecuted, nor will hereafter such be made; the best reason therefore being that there does not exist on this earth such vast unsurveyed lands fit for cultivation. But we saw in that year too, only too well, the handwriting on the wall.

"We have surveyed our heads off. Block and outline surveyor vied with each other in doing a big season's work, without any special financial benefit accruing therefrom, and the subdivider who worked on contract naturally completed as much as possible, all tending to hasten the approach of the inevitable, of having devoured so to speak the whole country with the instrument and chain. There will still be for some years a little to do, but the days of up fitting in Winnipeg and camping at Moosejaw are things of the past never to return. The functions of the Dominion Land Surveyor are about over and he must turn his face to pastures new and in another capacity. In this respect doctors and lawyers have the advantage over us; operating on a patient or client once does not necessarily kill him; in fact it is bad policy to kill him, but the public land admits of subdivision but once and then we are done.

"Our association, if it continues to exist, which I earnestly hope it will, must from force of circumstances become more and more of a scientific body, treating of such subjects as come within range of the Dominion Land Surveyor while acting in that capacity.

"The surveyors' coat of arms should undoubtedly bear the inscription, 'per aspera ad astra'; but while we have all of the "per aspera', little of the 'ad astra' is granted us."

In the proceedings of the fourth annual meeting, March 8th and 9th, 1887, a reference is made in the President's address (Thomas Fawcett) to the recent formation of the Ontario Land Surveyors' Association. A reference is also made to a memorial to the Honourable Minister of the Interior setting forth the public benefit to be derived from a trigonometrical survey to extend over the older provinces of the Dominion.

Advertisements appear in the proceedings for the first time. A list of members appended comprises 71 names, a slight falling off from the list of the previous year.

In the following years very comprehensive reports of the annual meetings were published, the largest report consisting of 194 pages of reading matter and 14 pages of advertising matter, this being the report of the Sixth Annual Meeting, February 19, 20 and 21, 1889. At this same annual meeting 19 papers were read besides a large number of committee reports. For scientific information on questions relating to the profession, these papers and reports were not exceeded by those of similar organizations at that time in the provinces or in the States. Other organizations were always glad to have the privilege of exchanging with our Association.

In 1891 the Association was affiliated with the Association of Provincial Land Surveyors for Ontario and shortly thereafter with the British Columbia Land Surveyors.

Survey work in the Canadian North-West gradually dwindled down until it was all handled by a small staff engaged by the year at a fixed salary. The secretary, A. O. Wheeler, to whom was largely due the credit for getting out the admirable reports, resigned his position, his post being filled by J. I. Dufresne. The members gradually became more interested in the provincial organizations, to the detriment of their own.

For the ninth Annual Meeting, February 1892, a break in the issue of printed proceedings occurred, due to the lack of funds. No printed proceedings were issued for this year but a resumé was included in those of the succeeding year. This latter report, namely that of the Tenth Annual Meeting February, 1893, was very much smaller than those of preceding years, comprising only 85 pages.

Owing to the gradual falling off of interest in the Association due to the dwindling down of Dominion Land Surveys at this time financial difficulties began to present themselves in real earnest. The membership fee was increased from two dollars to three dollars per annum and an urgent call was sent out by the Secretary-Treasurer to all members in arrears. Private funds from some of the surveyors even had to be resorted to to keep things going.

Under date of December 26th, 1893, circular letters were sent to each member by the Secretary-Treasurer asking if he were disposed to pay an increased annual fee, five dollars per annum being suggested, and mentioning the fact that, during the two preceding years twenty-one members had contributed over and above their annual fee a considerable amount to keep the Association clear of debt. The letter also mentioned that 52 members were in good standing at that date.

This letter was without tangible results. No artificial injection of life into the Association was possible. The future of Dominion Land Surveying seemed far from bright. The temporary demise of the Association took place at the 11th Annual Meeting on February 19th, 1894, with eighteen members present. The entire business transacted at this meeting had to do with the disorganization of the Association. On February 24th, 1894, the Secretary-Treasurer sent to each of the members of the Association a circular letter informing him of what had occurred at this meeting.

This in brief is a history of the early formation of the Dominion Land Surveyors' Association.

PARTIAL LIST OF DOMINION LAND SURVEYORS PRESENT AT THE FIRST MEETING IN WINNIPEG, APRIL 1882.

T. W. Armstrong,
Walter Beatty,
Edgar Bray,
A. F. Cotton,
Jos. Doupe,
T. Drummond,
Thomas Fawcett,
J. F. Garden,
R. W. Hermon,
Tom Kains,
W. F. King,
Otto J. Klotz,
C. A. Magrath,
C. F. Miles,
J. K. McLean,
J. J. McArthur,
William Ogilvie,
H. B. Proudfoot,
E. J. Rainboth,
G. C. Rainboth,
J. G. Sing,
A. C. Talbot,
W. T. Thompson,
I. Traynor,
C. E. Wolff.

EARLY EXPLORATIONS AND SURVEYS IN THE CANADIAN NORTH-WEST.

—BY—

R. F. CLARKE, D. L. S.

Hudson's Bay has played such an important part in the successive stages of the development of North Western America, that the history of that part of the continent must begin with the exploration of this inland sea. Its discovery was incidental to the search for a North West Passage to the East. Thus in 1500 A.D., when the Portuguese navigator Cortereal discovered the entrance of Hudson's Strait, without further investigation, he hurried home to announce that he had discovered the sought for passage. However, others who attempted to follow up his discovery met with misfortunes, until in 1610, Henry Hudson penetrated into the bay as far as the South Western coasts. Two years later, Thomas Button followed where Hudson had gone, and, wintering near the mouth of the Hudson River, named it after one of his men.

Other navigators extended these explorations, among them Captain James, who went as far as the south end of James Bay in 1631.

For two centuries after this, the search for the North West Passage to the Pacific was continued, chiefly by British navigators. While their persistence resulted in the discovery of all the Arctic lands lying to the north of the American continent, it also resulted in the death of many a heroic sailor.

When the more complete exploration of the shores of Hudson's Bay made it evident that if the North West Passage existed, it must be in a very northerly latitude, this same powerful impulse to reach the Western Sea seems to have seized explorers by land. They pushed westward and ever westward toward that vision of their ambition, to stand and look out over that great sea in the West. Yet a century and a half rolled by after the discovery of Hudson's Bay before it was vouchsafed to McKenzie to be the first to realize that vision.

About the middle of the 17th century, adventurous Canadians began to explore the country lying westward and northward from the French Settlements in Canada. The two names most prominently associated with the earliest discoveries beyond the Great Lakes, are those of des Grosseilliers and his brother-in-law Radisson. These men, during the years 1658 and 1659 made an expedition westward from Lake Michigan to the Great Plains and returned to Lake Superior. They were the first Frenchmen known to have explored Lake Superior, although the lakes below that were known before their time. This great lake attracted them so much, and the fur trade there proved so good that they returned again from 1661 to 1663. Travelling north from Lake Superior, they reached the shores of James Bay. A year later they went by a small ship from Quebec around to Hudson's Bay. But they could get so little assistance or even encouragement in these adventures from the authorities or merchants in Canada, that they finally drifted to England to seek assistance for further expeditions. The English merchants appeared more ready to venture in the fur trade. In 1668 des Grosseilliers sailed from England to Hudson's Bay, where he built a fort on Rupert's River. The next summer he returned to England with such a cargo of furs, that there was no further difficulty about interesting influential people in that trade. As a result, the Company of Adventurers of England trading into Hudson's Bay was formed with Prince Rupert at its head. In 1670, this company sent out ships and established Moose Factory.

The French soon realized the mistake they had made in allowing the service of two such enterprising adventurers as Grosseilliers and Radisson to be secured by the English. France made many efforts to lure them back to her service and eventually succeeded in doing so. Thus it happened that in 1682, we find these same adventurers again in Hudson's Bay, this time with ships from Canada. They established a post on the Hayes River. Naturally the French and English interests in Hudson's Bay very soon conflicted and for some years prior to 1714 France was in control there. In the latter year, however, England regained her territorial rights there by the Treaty of Utrecht, and has retained them ever since.

Before this time, regular posts had been established from Canada around Lake Superior and it is recorded that in 1688 a Frenchman named De Noyon wintered on the Lake of the Woods.

The name of Pierre Gaultier de la Vérendrye deserves great honor in the history of the Canadian West. He was a Canadian Seignior, born at Three Rivers. After some years of honourable service in the French armies in Europe, he was in 1728 in command of the Nipigon post on Lake Superior. No doubt it was during his stay here, while the Indians were bringing in indefinite reports of the vast countries lying to the westward, that ambition inspired Verendrye to explore those territories, and to pass over them to the shore of that mystic Western Sea. For many years, he pursued this purpose with an energy and determination which overcame not only the tremendous natural difficulties presented by the regions through which he travelled, but also jealous interference and opposition on the part of influential people in Canada. He was accused of seeking merely his own profit in the fur trade. As he received no assistance from the authorities in France or Canada, (except a monopoly in the prosecution of discoveries), he was forced to engage in trade to try to meet the great expenses entailed in fitting out his expeditions. The best evidence that he did not seek merely to enrich himself is that he expended what little property he originally had, in pushing forward his explorations and eventually died a broken man deeply in debt.

The circumstances under which de la Vérendrye laboured must appear almost incredible to us now. The only assistance he received from the government of France or Canada was permission to carry on his discoveries. Apparently, he would have been quite satisfied had that permission been whole hearted. All the expense of his outfits, and even the wages of his men, he had to provide himself. Not only that, but he was baulked at every turn by jealous people in Canada, who did their utmost while he was away to influence the governors against him. Time after time he was forced to return to Montreal because the supplies which he had arranged to have sent to Lake Superior were not sent. Thus, not only would his explorations be halted, but his associates in the West were in danger of starvation while he returned to the settlements to get the necessary supplies himself. How great must have been the zeal and determination of the man, to have struggled on under these conditions and to have achieved as much as he did-

It was probable that before Vérendrye's time, possibly during the 17th century, numbers of Canadian "coureurs de bois" penetrated into the country far to the west of the Great Lakes. But if they did, they left no records of their wanderings, for probably none of them ever returned. They became merged with the Indian tribes, among whom they settled.

Vérendrye attempted his first trip westward in 1731, accompanied by his sons and a son-in-law, de la Jemmeraie, but on reaching the Grande Portage, his men refused to go farther, so that he was forced to winter there, although he sent Jemmeraie on to Rainy Lake where Fort St. Pierre was built. The following summer Vérendrye succeeded in reaching the Lake of the Woods where he established Fort St. Charles. This fort then became his depot and in 1734 his sons established Fort Marépas near the mouth of the Winnipeg River, a few miles from Lake Winniepg. His opponents in Canada interfered with his arrangements so successfully at this time that he was prevented from making any further progress for several years. So it was not until September 1738, that Vérendrye succeeded in reaching the Red River He ascended this river and its branches, the Assiniboine, to the point where Portage la Prairie now stands. Here he built Fort la Reine and spent the winter. During this winter he travelled south-west across the prairies and reached the Mandan Indians on the Missouri River. The following summer his sons made explorations on Lake Manitoba and the lower part of the Saskatchewan River.

In 1741, Vérendrye's sons again journeyed across to the Missouri River with the intention of pushing westward from there to the Western Sea, but their presents for the Mandan Indians were stolen and as a result they could not secure guides to take them to the west. They were forced to give up that purpose for the present and return to Fort la Reine.

During the winter of 1741-42, a fort was established on Lake Manitoba and another called Fort Bourbon at the mouth of the Dauphin River on Lake Winnipeg.

In 1742 Vérendrye's sons again essayed the journey to the Missouri and thence westward to the sea. They actually reached the Rocky Mountains but the Indians who accompanied them would venture no farther. However, they spent fourteen months exploring the country north and south along the mountains about the head waters of the Missouri River and its tributaries.

In 1744 Vérendrye's eldest son built Fort Paskoyac, near the mouth of the Saskatchewan River. Five years later he ascended the river to the forks, a little below where Prince Albert now stands.

About this time Sieur de la Vérendrye died suddenly in Montreal while he was preparing another outfit for the West. The prosecution of the explorations he had set his heart upon, fell into other hands. Thus we find de Niverville in charge of Fort Paskoyac in 1750-51. During the summer of 1751, he sent ten voyageurs up the Saskatchewan to establish a post near the mountains. They ascended the South Branch and built Fort de la Jonquiere, either where Calgary now stands or some distance farther up. It is uncertain how long this fort was in use, though probably only for a season or two. In 1754 the Chevalier de la Corne built Fort de la Corne on the Saskatchewan a few miles below the forks. This fort retained its position and name for a hundred years afterwards.

Owing to the approaching struggle with England for the possession of Canada, the French forts were all abandoned in 1756 and so ended the French explorations in the West.

After the conquest of Canada, numerous independent English and Scotch traders began to engage in the fur trade and penetrated into the western country. But it was some years before they covered the range attained by the French. In other words, the wars, which culminated in Britain gaining possession of Canada, delayed the progress of exploration in the West by at least twenty years.

In 1770 a man named Curry reached the old Fort Bourbon on Lake Winnipeg and the next year Finlay was at Fort de la Corne on the Saskatchewan. Joseph Frobisher, conceived the idea of penetrating farther northward to intercept the Indians going down to the Hudson's Bay Company's posts on the coasts of the Bay. In the summer of 1772 he reached the Churchill River, probably by way of the Saskatchewan and north from Cumberland House. He met with such great success that many traders followed and by 1778 a post had been established on the Athabaska River a short distance above the lake. With many independent traders engaged in the business, there was naturally a great deal of opposition and rivalry. This reduced the profits. To make matters worse, in 1780 a fearful epidemic of smallpox sweeping northward from the United States, carried off so many of the Indians that the fur trade was still further injured. Many of the traders realized that the difficulties to be overcome required a pooling of their resources to make a strong organization and do away with conflict among themselves. With this object in view, in the winter of 1783-4, the foundation of the North West Company was laid in Montreal. In the spring of 1874 the company was organized at the Grand Portage.

At this time, Alexander MacKenzie, a young Scotchman of fine physique and daring heart, was a clerk in one of the Montreal firms largely interested in the North West Company. He went to the Indian country as a clerk, although soon afterwards he became a partner in the Company. In 1789 he was in charge of Fort Chipewan on Lake Athabaska.

From the end of the French régime up to this time, the various explorations made were undoubtedly incidental to the fur trade. The early rivalry among the independent traders induced many of them to seek new fields. Later when they combined to form the North West Company, there was the desire to divert as much as possible of the trade from the Hudson's Bay Company. So the fur trade offered a very powerful incentive to the penetration of new districts. However, the securing of a greater quantity of fur was always the one and only object in view.

In the case of MacKenzie, it was not so. He was actuated by a loftier vision. Beyond a doubt he realized, better in fact than his partners, that further explorations would benefit his company by opening up wider fields for trade. But he pushed his discoveries far beyond the point where they were of any immediate benefit to the fur trade. In both his major expeditions, he exhibited a determination which refused to be diverted, or to be deterred by the risk which lay before, until he finally reached the sea. That seemed to be the key note of his purpose, to reach the sea and know the bounds of the continent. He was an explorer first and a fur trader second. He was among those who saw the vision of the Western Sea, and the first to realize that vision in truth.

In the spring of 1789, MacKenzie decided to go down the river from Lake Athabaska and try to reach the sea. In spite of the stories of fearful rapids from the Indians, and the assurance that they would be old and grey-haired men, if indeed they ever returned, he set forth with four voyageurs and a few Indians. They passed through Great Slave Lake and from there down without a single portage reached the Arctic Ocean. In three months from their time of starting, they were back at Fort Chipewyan.

Encouraged by this success, he essayed a still bolder feat. Setting out from Fort Chipewyan in the autumn of 1792, he wintered at a post up the Peace River near the mountains, and started westward from there as early as possible in the spring. He ascended the Peace River through the Rocky Mountains and turned up the South Branch or Parsnip River, crossed to the Fraser River, followed it down to the Blackwater and from there struck overland across the Coast Range to the Bellakulla River. By this river he reached the Pacific Ocean on July 22nd, 1793. There he missed by only a few days, Capt. George Vancouver, who was exploring the Pacific Coast. He returned on the route by which he had come and reached Fort Chipewyan before the winter set in. Soon after this MacKenzie went back to Montreal and did not return again to active work in the West.

However, the North West Company, in its search for new fields of trade, developed other great explorers. The most notable of these was Simon Fraser, a native of Glengarry. He was sent by the Company in 1805 across the Peace River Pass into the country west of the mountains, which then began to be called New Caledonia. He was to make further explorations and establish new posts. Two years later he went down the Fraser River and reached its mouth on July 1st, 1807. In the course of this journey, he discovered the junction of the Thompson with the Fraser River.

In the case of all of these explorers, from the Sieur de la Vérendrye, down to Fraser, while they ventured into unknown regions, established posts and opened up the way for others to follow them, still their records of the country explored were very incomplete and inaccurate. It remained for David Thompson to really make the first map of the whole of the North West. Thus, while he did a good deal of actual exploring, particularly throughout the valley of the Columbia River, his chief title to fame is that he accurately surveyed and mapped all the principal topographical features of the Canadian West, chiefly, of course, the rivers and lakes. Mr. Tyrrell regards him as one of the greatest land geographers the world has produced and says of him.* "Thompson was not a spasmodic explorer; with him surveying was his chief pleasure, and life work."

Thompson came to America in 1784 as an apprentice, fourteen years of age, in the Hudson's Bay Company. Among the subjects on the curriculum of the Grey Coat School in London, where he received his small amount of education, was that of navigation. Even so the instruction he received on this subject must have been very elementary. On his arrival at Hudson's Bay, he spent a year at Churchill under Samuel Hearne, one of the few H.B. Company officials, who had shown any enterprise in going inland from the Bay. In 1770 Hearne had crossed on foot from Fort Churchill to the mouth of the Coppermine River. He had also ascended the Saskatchewan and established Cumberland House in 1774.

Thompson began his surveying on the Saskatchewan and Hayes Rivers in 1789. He spent the winter of 1789-90 at Cumberland with Philip Turner, the principal surveyor of the H. B. Company at that time. During that winter they made observations for latitude and longtitude. Thompson probably obtained valuable instruction and experience. From this time he appears to have formed a broad plan for the prosecution of his surveys. From then on, wherever he went, he made careful traverse notes of the routes followed, and by making latitude and longitude observations at the various posts where he stopped, he was able to accurately tie in his compass traverses. In writing to a friend he speaks of his sextant as his constant and loved companion. The accuracy of his observations with this simple instrument is marvellous. With all the refinements of modern methods for these determinations, the error in his location of points has never been found to exceed a few minutes of arc. Furthermore, his traverse notes were so complete that he was able from them to draft his map of North Western America after he retired from the country in 1812, fully twenty years after some of the notes had been made.

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*Thompson's Narrative of his Explorations in Western America 1784-1812, edited by J. B. Tyrrell.

In 1796 Thompson explored the route from the Churchill River northward through the Deer and Wollaston Lakes to the east end of Lake Athabaska. A year later, having received so little encouragement in his work from the Hudson's Bay Company, he left them and joined their more enterprising rivals, the North West Company.

From that time until 1812, Thompson remained with the latter company, serving them as a trader, but chiefly interested in making surveys wherever he went. From 1805 onward his efforts were chiefly devoted to the Columbia River district, which he reached from Rocky Mountain House at the head of the North Saskatchewan. He returned from the North West in 1812. During the following two years he made his map of that country from the notes he had collected during the previous twenty years.

It was at this time that the Earl of Selkirk secured a controlling interest in the Hudson's Bay Company and had them cede him a large tract of land in the Red River valley for the purpose of founding a colony. It is unnecessary to restate the details of all the misfortunes which followed that colonizing effort. The settlement became involved in the savage conflict between the North West and Hudson's Bay Companies, as well as suffering from misfortunes of natural origin which overtook it. In spite of these difficulties and repeated set-backs, by 1821, when the two rival companies were finally united, the colony had become firmly established. Its population was largely augmented at that time by the settling there of many of the employees of the two companies whose services were no longer required when they became one.

As already stated, the Red River Settlement was formed on a large tract of land ceded by the Hudson's Bay Company to Lord Selkirk in 1811. It became known as the District of Assiniboine. Its government consisted of a governor appointed by Selkirk or afterwards his executors, and a council, called the Council of Assiniboine, composed of the leading citizens of the settlement.

In 1835 the land rights were returned to the Hudson's Bay Company and continued under their control until purchased by Canada in 1868. Under the jurisdiction of the Company, the Red River Settlement was governed by a governor and a council, both appointed by the Company, although the council consisted largely of the leading men of the settlement.

As surveyors, we are chiefly interested in this first settlement in the West, in connection with the surveys of the lands occupied by the settlers, and the men responsible for those surveys. These men were really the pioneers in the work upon which we, as Dominion Land Surveyors, are engaged.

One of the earliest surveyors connected with Selkirk's colony was Mr. Peter Fidler. Like Thompson, Fidler came to America as an employee of the Hudson's Bay Company, probably arriving at York Factory about 1793. But he remained in their employ as a trader and surveyor.

An interesting incident regarding him is given by the Abbe Dugas[*]. In 1809 he was sent with eighteen men to open a trading post at Isle a la Crosse in opposition to the North West Company. The first winter there he was fairly successful in trading. But the North West Company did not approve of the mild methods of their agent at Isle a la Crosse which allowed Fidler this measure of success. They sent Duncan Campbell to take better charge of the North West Company interests in that region. Campbell immediately asked for more men and built a house a few rods from Fidler's post. Here he installed a gang of particularly bold and lawless men to interfere with the Hudson's Bay Company's trade and to harass the Company's men. Their firewood was stolen, their fishing lines were carried off at night, they were bothered if they went out to hunt and finally they found their fishing-nets, their main source of livelihood, cut to pieces. Finally the North Westers became so bold that they came to Fidler and his men and ordered them in a formal manner not to stir out of their fort again. Being overpowered by their superior numbers accompanied by such acts of violence, Fidler was compelled to leave Isle a la Crosse and the North West Company burned down his fort a day or so after he had gone.

Fidler appears to have gone to the Red River district soon after this incident and to have made an early map of that region. Lord Selkirk in his instructions in 1811 to Miles MacDonell regarding the founding of the colony, refers to a certain point on the Red River as marked in P. Fidler's survey. He seems to have been connected with the settlement almost from its inception. In the summer of 1814, he was employed by Miles MacDonell in laying out lands. He made the survey of the boundaries of the District of Assiniboia and a map of the Selkirk Settlement. In 1814, in writing to Selkirk, Miles MacDonnell says.[‡] "We require to have a permanent surveyor that would keep a regular office, and Mr. Fidler might answer the purpose. His Indian family is some objection to him. He is far from being a well polished man and is not well liked by the people, but I think him a well meaning man. I set off to-morrow for York. Mr. Fidler takes charge of matters here until my return."

Fidler was a member of the Council of Assiniboia for some time. He died at Norway House in 1822. During his life he accumulated a small library which was in 1848, incorporated in the public library of the Red River

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[*] The Canadian West—Its Discovery by the Sieur de la Vérendrye—Its Development by the Fur trading companies down to the year 1822, translated from the French of Abbé G. Dugas.

[‡] Publication 9, Canadian Archives Vol. I., Page 56.

Settlement. Vol. 69 of the Selkirk papers contains his Journals and his meteorological journal and astronomical observations.

It is interesting to note the instructions for surveying contained in the memorandum of guidance made by Alexander MacDonell as agent for Selkirk's executors in 1821.* They set forth that in laying out lots, a base line ought to be taken and marked out parallel to the general course of the river without reference to the points or bends—and the boundary lines between lots drawn at right angles to this base line, to the river at one side and to the extent of the Indian grant, or two miles back, on the other,—all lots to have a front of 8 chains on this base line.

Another surveyor connected with the early days of the settlement was William Kempt. He came out from Scotland as surveyor for the colony at 100 pounds per annum and took up the work where Fidler had left it. In 1822 he laid out lots on Image Plain and the following year drew up a plan of a village on the Assiniboine River. Thus at this early date we find an example of the practice of town planning or possibly an attempt to solve the problem of a community settlement. Governor Bulger wrote of Kempt: ‡He is surpassed by no man I have ever known in zeal and industry in the performance of his professional duties." During the period of two months from Governor Bulger's departure, until the arrival of Governor Pelly Kempt was assigned the nominal charge of the colony. He subsequently returned to Scotland and resumed his profession there.

In the records I have had an opportunity of consulting, no further surveyors are mentioned in connection with the settlement until 1841, when Mr. George Taylor became Surveyor and Superintendent of Works at a salary of £12-10, under the Board of Public Works. It seems probable, however, that before this time, there must have been a surveyor constantly in the colony. The office, to which Taylor was appointed, was abolished in 1844.

For some time after that there appears to have been no regular surveyor at the Red River, for in 1824 the Council of the settlement applied to the Hudson's Bay Company for the appointment of a good surveyor. In the following year, the Council resolved "That a public land surveyor be appointed with a salary of 21 pounds, and that he shall be authorized to charge not more than 7s. 6d. each day he is employed by private individuals." Mr. Wm. Inkster was appointed.

Mr. Inkster's appointment does not seem to have proved universally popular. The Canadian population were dissatisfied with him as they could not understand him. He was therefore warned that his service under the agreement above mentioned, should cease at the end of May, 1816. There must have been some further objections to his work as a surveyor, however, for, when on the 27th May, 1816, it was agreed by the Council that two surveyors should be appointed, Mr. Roger Goulet was appointed to that part of the settlement south of the Assiniboine River, while it was left to the Governor to appoint one for the north side of the river. Apparently, the Council at the same time considered they had been rather too liberal to the surveyor under the old arrangement, for now the surveyors were to receive no salary from the public funds, although they were allowed to charge up to ten shillings a day for their services. No mention is made of what surveyor was appointed for the remainder of the settlement, until in 1860, when Herbert L. Sabine was given permission to engage in surveying upon the same terms as others employed in that work.

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*Publication No. 9, Canadian Archives, Vol. I., page 45.

‡Publication No. 9, Canadian Archives, Vol. I., page 215.

During the following ten years, Goulet played quite an important part in the affairs of the settlement. Whether he continued the practice of surveying along with his other duties and responsibilities seems uncertain. In 1862 he was appointed collector of customs at Upper Fort Garry with a salary of 25 pounds a year. He became a member of the Council in 1866 and two years later was made a Justice of the Peace. He appears to have been regarded as something of an engineer too, for in 1869, he was a member of a committee to consider Assiniboine River at the forks. During the disturbed conditions in the autumn of that year, he was entrusted by the Council with the difficult mission of proceeding to the camp of the party who were determined to prevent the entrance of Governor MacDougall into the new province. Goulet was to endeavour to procure the peaceable dispersion of this party. In this, unfortunately, he was not successful. Afterwards when Riel formed his provisional government, he endeavoured to have Goulet accept office under him. Goulet, as a result of his refusal to do so, had the unique experience of being imprisoned for refusal to accept a government office.

One other point of surveying interest in connection with the Red River Settlement, is a resolution of the Council of the 27th Feb., 1860. This provided that in case of difficulties arising between persons who take land outside of the part of the colony already surveyed, the magistrates were authorized to act on the principle that 12 chains should be the limit of the preemption right arising from occupation. According to Mr. William Pearce, this was the width allowed to many of the lots laid out in the Settlement. How long the earlier regulation of a lot 8 chains wide on a base line was in force, and whether it was superceded by the 12 chain lots without the intervention of any other systems, I have not been able to determine.

As soon as the Canadian Government had consumated the transfer of the lands in the West from the Hudson's Bay Company, Col. J. S. Dennis was sent out to commence surveying operations around the Red River. He was stopped in his work by the insurgents in 1869, and subsequently played no small part in the events which took place during the Red River Rebellion. It was he who worked out the first system of surveys in the West, a complete history of which may be found in the report of the Department of the Interior for 1891.

While I have followed up the surveys of the Red River Settlement from its inception until it became a province of the Dominion, I have neglected to mention explorations which took place in other parts of the West during this period.

Even after Thompson and the explorers who preceded him, completed their surveys of the Canadian West, there were still some regions which were very little, if at all, known. These were particularly the districts between Great Slave Lake and Hudson's Bay, and those parts which now comprise Northern British Columbia and the Yukon.

The region to the west and north of Hudson's Bay was first penetrated by Hearne in 1771. No further explorations are recorded until 1819, when Sir John Franklin made his journey from York by way of the Saskatchewan, Churchill and Athabaska Rivers to Great Slave Lake, and from there down the Coppermine River to the Arctic Sea. He was accompanied in this expedition by Sir George Back and Sir John Richardson. They appear to have been the first to explore the whole course of the Coppermine and parts of the coast around its mouth. Sir John Franklin made another expedition in 1825-27, going from Canada to the Athabaska, Great Bear Lake, and down the MacKenzie River to the Arctic and thence along the coast eastward to the Coppermine, returning to the Athabaska by that river. Sir George Back commanded an expedition from 1833-35 to search for Sir John Ross who was then supposed to be lost in Arctic lands. He proceeded from Canada to the Athabaska and Great Slave Lake. He built Fort Reliance at the east end of Great Slave Lake ,and using that as a depot struck out to the north-east, discovering the Great Fish or Black River. He followed it to the sea and returned by the same route.

This north eastern region of the Canadian West was largely explored as we have seen by expeditions sent out from England. The district at present comprising Northern British Columbia and the Yukon, was, on the other hand, opened up as a result of the desire to further extend the fur trade. When the North West Company became merged in the Hudson's Bay Company in 1821, it seems to have infused some of its enterprise and energy into the older and more conservative organization. At any rate, the following twenty years was a period of great activity on the part of the Hudson's Bay Company in seeking new fields for trade. They also appear to have been very ready and liberal in their assistance to the expeditions of Franklin, Back and Richardson. In addition to giving every assistance to these explorers, about 1837, they sent an expedition of their own under Chief Factor P. W. Dease and Chief Trader Thomas Simpson to the Arctic coast. These men successfully outlined unknown portions of the Arctic coasts to the east and west of MacKenzie River, continuing their efforts for two or three years.

Before this time, John Bell, another Hudson's Bay Company employee, crossed the Rocky Mountains from Peel's River near the mouth of the Mac Kenzie. He discovered the Porcupine River and descended it to its junction with the Yukon, where he established Fort Yukon.

About 1835 John McLeod ascended to the head waters of the Liard River, passing through the Rocky Mountains. From there he discovered the sources of what was then named Pelly's River, now known as the Yukon. McLeod's discovery was followed up by Postmaster Robert Campbell who showed great enterprise and determination in explorations in this region. Campbell finally succeeded in crossing through the mountains from the Liard to Pelly's River, which he descended to Fort Yukon at its junction with the Porcupine River. By these successful efforts Campbell won the name of "The Livingstone of the North West."

I have endeavoured to outline the course of the discovery and exploration of all the great river systems of what was then the north western hinterland of Canada. Owing to the restrictions imposed by nature on the mode of travel, these early explorations and surveys were almost entirely confined to the water courses. As the conception began to dawn upon the people of Canada and Great Britain that this vast stretch of country might be of some value other than as a great fur reserve, other explorations were instituted to determine the possibilities of the country for wider colonization, and for the establishment of communications to and within the territory. Even in the fifties, the possibility of a railway across the country to the Pacific was considered by a few of the more far-seeing statesmen. Efforts were being made to build such a line in the United States. In both Canada and Great Britain another incentive to exploring and occupying the West more fully was the fear that, with the American settlements extending westward so rapidly, they might occupy the country. Furthermore, the people of the Red River were raising many complaints regarding their position under the Hudson's Bay Company and were particularly eager for better communications between their settlement and the outside world.

During the latter part of the fifties, all these influences combined to create a very lively interest on the part of the people of Canada and Great Britain in the possibilities of the western country. Their interest was evidenced in enquiries by both governments to collect more accurate information from people familiar with the country, and by the sending out of expeditions to more fully explore the country and report upon it. There was an enquiry instituted by the Legislature of Canada, and in England there was the Select Committee on the Hudson's Bay Company. In the period from 1857 to 1861, three important expeditions were sent out, Captain Palliser by Her Majesty's Government and Mr. S. J. Dawson, C.E., and Mr. Hind, M.A., F.R.G.S., by the Canadian Government.

The expedition under Captain Palliser was sent out in 1857 to explore the country between Lake Superior and the Rocky Mountains, and also to ascertain whether any practicable passes, available for horses, existed across the mountains south of that known as the Boat Encampment Pass, the one first used by Thompson Owing to the limitation in this last clause, Palliser did not, of course, investigate the best passes which lay to the north of the limit imposed on him. As a result, after four years of work, he reported very unfavourably upon the project of a line of communication across the continent entirely within British territory, on account of the difficulties to be encountered both between Superior and Red River, and through the Rocky Mountains.

About the same time, the Canadian Government sent out Mr. S. J. Dawson, particularly to examine the country between Lake Superior and the Red River with the view of opening up a line of summer communication on British territory between Canada and the western settlements.. Mr. Dawson reported in 1859 on a combined road and boat route following much the same course as that used by the old North West Company. The principle difference was that waggons were to be used from Lake of the Woods direct to Winnipeg, instead of going around to the north by the Winnipeg River. The Canadian Government placed the sum of $20,000 per annum for five years at the disposal of the North West Transit Company for the purpose of developing this communication. It became known as the Dawson Route.

The Canadian Red River Exploring Expedition was sent out from Canada in 1857 under Mr. H. Y. Hind. The following year Mr. Hind extended his investigations westward as far as the South Branch of the Saskatchewan. He covered all the country from the Red River westward to the South Branch and northward to the main Saskatchewan. He was to report on the geology of the country, its possibilities for agriculture, and the possible development of means of communication.

Finally when Canada bought out the Hudson's Bay Company rights in the West, there were the numerous explorations and surveys made under Mr. Sanford Fleming, engineer in chief, to determine a route for the Canadian Pacific Railway. But these expeditions belong to the succeeding period of Canadian control in the North West.

The following historical works have been consulted in the preparation of this sketch.

1. "History of Canada" for the High School of Ontario, by Prof. W. L. Grant.
2. "The Canadian North West—Its Early Development and Legislative Records".
   Publication No. 9 in two volumes of the Canadian Archives.
   Edited by Prof. E. H. Oliver.
3. Report from the Select Committee of the British House of Commons on the Hudson's Bay Company, together with the Proceedings of the Committee, Minutes of Evidence and Appendix.
   Ordered to be printed 17th August, 1857.
4. "The Canadian West—Its Discovery by the Sieur de la Vérendrye—Its Development by the Fur Trading Companies down to the year 1822."
   Translated from the French of Abbé G. Dugas.
5. Thompson's Narrative of his Explorations in Western America 1784 1812.
   A Publication of the Champlain Society.
   Edited by Mr. J. B. Tyrrell.
6. "MacKenzie's Journal".
   Edited by Sir Alexander MacKenzie himself.

7. Narrative of the Canadian Red River Exploring Expedition of 1857, and of the Assiniboine and Saskatchewan Exploring Expedition of 1858.
   In two volumes, by Henry Youle Hind, M.A., F.R.G.S.
8. "Ocean to Ocean"—Sandford Fleming's Expedition through Canada in 1872.
   By the Rev. George M. Grant.

Mr. William Pearce, D.L.S., kindly permitted me to read also the draft of a treatise he was preparing on "Titles to Land in the Three Prairie Provinces."

I regret that I did not have the opportunity nor the time to consult any of the following valuable books of reference on this subject.

1. Saskatchewan and the Rocky Mountains,
   By the Earl of Southesk.
2. History of the North West,
   By Begg.
3. The Remarkable History of the Hudson's Bay Company,
   By Bryce.
4. The Hudson's Bay Company Land Tenures,
   By Prof. Archer Martin.
5. The Journals of Captain Palliser's Explorations,
   Published by Her Majesty's Government.
6. A History of the Red River Settlement,
   By Prof. Archer Martin.
7. The Search for the Western Sea,
   By Lawrence J. Burpee.

THE CHAIRMAN: We are deeply indebted to the members of the Historical Committee who have taken part in the preparation of this interesting Report. The work done by Mr. Clarke himself has been enormous. Unless a person has himself done something along this line he has no idea of the amount of work that is involved, and to undertake it without remuneration is more than the average man will do.

MR. CLARKE: In that connection I may say that I did not do it for nothing, because the benefit I derived from reading these books was worth all the trouble I took.

MR. HERRIOT: I have done a little research along that line, and I quite agree with Mr. Clarke, that if one had the time to look into these old records, he would spend it very agreeably and very profitably. I do not think I ever read a book that dealt with the matter more completely than the narrative of Mr. Thompson, the man whom J. B. Tyrrell regarded as the greatest geographer this country has ever seen. Mr. Clarke might have elaborated a little more upon his life and labours. Away back in 1785 or 1786 he took observations with a sextant and located the position of Cumberland house in longitude down to the minute of an arc. That is a great degree of accuracy in observation with the sexant; if it had been in latitude, of course we would not say very much about it. He also established the longitude of York factory within three minutes, I believe, of the present location. You would be surprised at the accuracy that he secured, and all the observation was made with the sextant. Although he had studied mathematics a little in the public school in England, he came here with almost no experience in surveying, but he applied himself assiduously to the study of the work. He used to spend night after night in observations, determining latitude and longitude, using lunary distances for the determination of longitude. The interest of these books is due to the fact that men wrote exactly what they were doing and how they were doing it. If we surveyors were to leave records like that behind us we would be doing something worth while. As for the diary that we put in, while it may be an official record of what we do, it contains practically nothing of interest. If we wrote diaries such as these early narratives were we would leave a record which in future years would be a vivid account of the efforts of surveyors in the earlier days.

MR. McELHANNEY: I suggest that the discussion of Mr. Clarke's paper be continued after luncheon. There are many matters of interest in connection with it which many surveyors here may wish to discuss.

The Meeting adjourned for luncheon.

FRIDAY AFTERNOON SESSION.

The Meeting resumed at 2.30 p.m., the President in the Chair.

THE CHAIRMAN: Will Mr. Hawkins continue the discussion on Mr. Clarke's Report ?

Mr. HAWKINS: This paper has been of very great interest to me; it has given rise to many memories. 1882 was the first year that I was on a survey. I was in Winnipeg, and was quite a youngster serving my time. I would like to have seen a little more mention made of some places in the Yukon Territory; some interesting phases of the history of early explorations are centered around that district. The Hudson Bay Company had a post at Fort Selkirk, up the river from where Dawson City is at the present time; and they had another down the river at Fort Yukon. Both these posts were abandoned. Fort Selkirk was destroyed twice, I believe, by the Indians, and Fort Yukon, after considerable trouble with some of the Russian and American traders, was taken over by the A. C. Company, as we called it, now the Northern Commercial Company. Some of the incidents in the history of the exploration of that country are very interesting. In one of his memoirs, Dr. George M. Dawson gives a most interesting account of his explorations through that part of the country, going in by way of the Stikine, thence across into the head waters of the Pelly and down into the Yukon River. The head waters of the Stikine were at one time the site of a very famous gold camp, and there was quite a population there. I do not know that I have anything else to add; the Report of this Committee is undoubtedly an excellent one.

MR. SEIBERT: This is the most important paper that we have had at our Annual Meeting; no other paper will do so much to educate the public as to the value of the services which surveyors have rendered to the community. I suggest that this paper be printed in pamphlet form—it should also be included in the report, of course,—I do not know what the cost would be, but I leave that with you as a suggestion.

MR. HENDERSON : We got 500 copies of the report last year for $336: that is at the rate of about 66 or 67 cents each. Probably such pamphlets could be printed at 15 or 20 cents each.

MR. HERRIOT: What was the cost per page for the printing of the Annual Report ?

MR. HENDERSON : $1.70 for 500 copies. We could arrange with the printer to save the forms of this paper from the Report.

MR. SEIBERT : How about putting a motion that 500 copies of this Report be printed in pamphlet form ?

MR. HERRIOT : Five hundred would hardly be enough. We would want to send a copy to every member of the Dominion Parliament, and by the time we got around to every university and every library in the country, five hundred copies would not be sufficient. This paper should go before every member of the Provincial Legislatures. I would not suggest that the paper be published in serial form, because in that case a great many people would not read it, especially the men whom we want to reach. But if it is sent out in pamphlet form, those who receive it will look into it a little, at any rate.

MR. NORRISH : Could we not think of some way to finance this scheme so that we could publish the Report not in pamphlet form but in the form of a little book, properly bound, so that the copies would be kept when received and not thrown away ? Most pamphlets which are sent to members of Parliament find their way to the waste paper basket without being read at all, but a neatly bound book would most likely be retained and possibly examined at some time.

THE CHAIRMAN: It might be possible to get some help from the Department, because this is an historical treatise on the work of a particular branch of the public service. Perhaps we could get them to publish it for us.

MR. SEIBERT: Of course, we have to consider our finances. All we can do at present is to express our approval of the publication of this Report in some such form as has been suggested; then we can leave the matter to the Council or to the Executive. I move, therefore, that this meeting declare itself to be in favour of the publication by Council of this Report in pamphlet form, provided our finances are sufficient to cover the cost.

MR. BOULTON : I second the motion.

MR. McELHANNEY : Perhaps Mr. Clarke has not completed what he might do along this line. We ought to have him on this work again next year, and although the Report is pretty complete as it is, still he might be able to supplement it.

MR. HENDERSON : I suppose Mr. Clarke has no objection to offer to our making so free with his paper ?

MR. CLARKE : I have no objections, of course, to your doing anything you like with the paper. It is really part of the Report of the Committee, and the Association is at liberty to do what it likes with it. I must say that I feel a little diffident about having it sent broadcast throughout the land. I do not pose as an authority on history or even as a student of history, and I would feel a little modest about presenting this as an historical work to many people throughout the country who are much more familiar with the subject than I am. But if the Association does decide to publish it as suggested I will try to get some maps which will add very greatly to the value of the sketch if they are incorporated in it.

With regard to Mr. McElhanney's suggestion, my idea this year was simply to make an outline, with a view to its being elaborated somewhat in another year. I feel that I must ask the Association, however, to pass that work on to somebody else. This summer I shall be too busy to give to the subject the time that I feel it would require; moreover, I shall not be in the same position that I was last year of getting hold of the information. As I suggested in the Report, a good deal of the information could be got much better by someone who had access to libraries in the Winnipeg and Saskatchewan universities.

THE CHAIRMAN : Land surveyors are not supposed to be historians, and the mere fact of their having compiled such an historical sketch as the one which has been read by Mr. Clarke shows them to be versatile.

The motion was adopted unanimously.

THE CHAIRMAN : Is there any further new business ?

MR. HAWKINS : It seems to me that we ought to delegate our new President to represent this Association at the Ontario Land Surveyors Meeting which takes place shortly in Toronto and to set before them the proposal of a Surveyors' Institute for Canada which was so ably outlined to us by Mr. Stewart. We ought to send a representative there who will point out that we are in full sympathy with that project and try to interest the Ontario land surveyors in it.

MR. SEIBERT : I do not think it is fair to load this on the President. I am an O.L.S. man myself. I would like to see someone who is not a member of the Ontario Association; I will assure him of my support. After all, we have to get at the thing in the best way that we can, and I think I can do more by going there as a member of the O.L.S. Besides, we must not forget that we have authorized Council to appoint a Committee to attend to this matter.

MR. HAWKINS : But this meeting is to take place soon.

MR. SEIBERT : Then I know of no better man to represent us there than Mr. Hawkins. We want a man of some standing; a man who can put the matter as plainly as I know Mr. Hawkins can put it. He has lived in Ontario a good many years; he knows a great many of the O.L.S. men—more than I do. That counts for a whole lot in going into a new gathering and presenting a new project for discussion. I understand that at the O.L.S. meeting last year the suggestion was turned down, so we have to step carefully. It is not a matter of shoving it through; it is a matter of convincing

THE CHAIRMAN: There is a good deal in what Mr. Seibert says; the representations of a D. L. S. man might carry more weight than those of an O.L.S. man at that meeting.

MR. PIERCE: When Mr. Seibert's name was first suggested I thought that he was the best man that we could get; but since he has presented his objections I concur in the suggestion that Mr. Hawkins represent us. In the natural course of events some others of us will be there and at that meeting we will be Ontario land surveyors, not Dominion land surveyors; and we shall be able to help very considerably anyone who comes as a representative of the Dominion Land Surveyors. I would be glad to see Mr. Hawkins there and to assist him in any way that I can. I was at a meeting of the O.L.S. Association a few years ago when Mr. Hawkins represented the D.L.S., and I remember the favourable impression created by his appearance. He will go to them not as a stranger, but as an accredited delegate whom we already know. I think that the selection is a very worthy one. .Applause).

THE CHAIRMAN : The meeting unanimously approves the selection of Mr. Hawkins as representative of the Dominion Land Surveyors Association at the coming meeting of the O.L.S.

MR. McCLOSKEY : Was any notice sent to the men on the office staffs regarding the meeting this year ? Very few of them have been in attendance; it seems to me that there must be some misunderstanding.

MR. HENDERSON : We had a Committee looking after the printing of the Programme and they had 250 copies of it printed. As Secretary, I undertook to send these to all the members out of town. and my understanding was that copies of the programme would be distributed among the men in the office of the Surveyor General by the members of the Committee. I suppose the members of the Committee thought that I would do it, and the result was that nobody seems to have done it. That is unfortunate, but even so I do not see how the men could be at the office for the last month or six weeks and not know about this meeting.

MR. MACILQUHAM : I am one of the office men; I think I got a copy of the programme. I knew of this meeting, but I was not able to get here until to-day. But so far as I am aware, no invitation was extended to the office staff to come here. I do not mean by that that the members of the

Association in the office did not receive notification. A lot of the office men are not Dominion land surveyors, and I think it would be a good thing if a general invitation was issued to them to attend these meetings. I have asked half a dozen D. L. S. men to come, but they all say, "Well, we didn't get any invitation; we don't know whether or not we are wanted." I think it would be a good thing if the office men could come here. There are a lot of things that they could learn at these meetings: benefit would result to both office men and surveyors. (Applause).

THE CHAIRMAN : Has it been customary to send invitations ? It was generally understood, was it not, that these meetings were open to them without any special invitation being extended ? I thought it was generally understood that they were welcome.

MR. HENDERSON : On Tuesday morning or Wednesday afternoon I said to Mr. Shanks, the Assistant Surveyor-General, "Would it be well to pass the word around among the staff that they are free to attend the meetings of the Association ?" He thought not; he thought that that would make it too official. But he was quite agreeable that any man who wished to come here should do so as in past years. He did not want to make it an official leave of absence.

MR. MACILQUHAM : Mr. Shanks' stand is quite a proper one. But there is no doubt that the men in the office as a body did not know about the meeting; it was not impressed upon them at all. I do not think that there was even a notice of the meeting posted in any part of the building. I do not know whose fault it is; I am not blaming anybody in particular. But that is the case.

MR. McELHANNEY : There has been some misunderstanding with regard to the distribution of copies of the programme. However, there was one posted up on the main wall of the Topographical Survey Building; I do not know about the Imperial Building. There was one put up downstairs the first day the programme was out; I do not know what became of it. I was given some copies of the programme, and although I did not understand that I was supposed to distribute them there, I gave several copies to men in the building. I did not go round and distribute them. In fact, I had about a dozen or fifteen, and yesterday I had none left; so there were that many distributed anyway. I think that the thing must have been pretty well known, although certainly it could have been better advertised among the men. Whether the smaller attendance of office men this year is due entirely to this matter of the distribution of the programme, I do not know.

MR.HERRIOT : I do not believe that we need to make any apology for not distributing copies of the programme to members of the Association who are in the office. It is in their own interest to be here. They should keep themselves posted on what the Association is doing. If they did not get the programme, they should have taken steps to obtain it. The constitution calls for a meeting in February; they must have known that it would be held about this time—that is, as far as the D. L. S. men in the office who belong to our Association are concerned. As to the other men in the office, the members of the Association who are in the office and who must have been aware of the meeting were remiss in their duty in not directing the attention of the office staff to the fact that the meeting was to be held, and informing them that they were welcome. I had one of the office men with me at the luncheon yesterday, and I asked him why he had not been attending our meetings here. He said that as far as he knew, no one in the office had been informed that he was at liberty to absent himself from the office for the purpose of attending the meetings. That is, they felt that the heads of the different sections or divisions did not look with favour on the going out of the office, even to attend these meetings. Well, if that is the attitude of the heads of divisions, it is only natural that the members of the office staff should hesitate about going. I quite agree with Mr. Shanks' attitude in the matter, but the heads of divisions might reasonably have signified their assent in some way, even though they did not announce it to the men in a body.

MR. MACILQUHAM: I do not think that Mr. Herriot is quite right about that. So far as I know, the chiefs of rooms made no objection; in fact, so far as our office was concerned, we were asked if we were not going to go. I do not know that any of the chiefs made any objections.

MR. HERRIOT: I did not say that the chiefs made objections. I said that they did not let the men know that they were at liberty to go, and the men naturally hesitated to ask for permission.

MR. MACILQUHAM: So far as I know, the men were at liberty to go if they wanted to go. Mr. Herriot spoke of men in the office who are members of the Association not having the programme. Now, I think I got a copy; I think all the members did. But my point was with regard to the men in the office who are not members of the Association. Some sort of invitation should be extended to these men from the Association so that they would feel that they were welcome.

THE CHAIRMAN: An official invitation through the Secretary?

MR. MACILQUHAM: Some notice should be put up to the effect that the Association would be glad to have them attend. They are not members, and unless they are invited to come here by some members of the Association I do not see why they should come.

THE CHAIRMAN: They have always come in the past.

MR. HAWKINS: During the winter a letter was sent out by the Deputy stating that no meetings were to be held during office hours. That may have influenced some of the office men; they may not have felt at liberty to take the time to come here as they did in former years.

THE CHAIRMAN: Well, gentlemen, is there anything else? How about Mr. Plunkett's suggestion of yesterday that all surveys for the Government should be under a Commission? So far as our Minister is concerned, there is no doubt that he would support that suggestion; I gathered that from some conversation I had with him.

MR. PIERCE: This is a very wide and far-reaching subject. I suppose, however, that we might express our appreciation of the importance of unification of control of all these surveying undertakings and that we should be ready to assist in any way possible toward its consummation. Perhaps someone else may be able to make a concrete suggestion as to what action we should take.

MR. HAWKINS: It seems to me that the Government, the heads of branches, are overlooking a great opportunity. This present reclassification might better be called "reorganization". For instance, some three or four different branches or departments of Government are doing levelling. Some of these branches are running levels over ground that has already been levelled; I know two or three places where they are duplicating lines of precise levels. This cannot be done, we know, without considerable cost. When Dr. King was alive the Astronomical Branch, Geodetic Branch and Boundary Survey were all under one head, and I do not think that department was ever more efficiently administered than it was under his administration. Now there are three different branches. At one time I understand that Waterpowers, Reclamation, Forestry and a number of these things were under the Topographical Surveys Branch; now they are all scattered about. If all engineering branches were co-ordinated under one non-political head, a Director of Engineering, or something of that sort, much more efficiency could be attained in the engineering work necessary throughout Canada. That is just an outline; I have thought of this matter for a long time without putting my ideas into tangible form. It has always seemed to me that a great deal of our energy was being expended without getting the results that we should get.

MR. SHAVER: Such an important matter as this should receive more careful consideration. One method of having it more thoroughly discussed would be to hold an open meeting and have it attended by all who are interested in surveys. A number of men could gather together all the information they could on the subject, and we could collect some ourselves; then after an exhaustive debate we might have strong views one way or the other. We would get more information that way than by pursuing any other course; and it is information that we are after. It is possible that we would be convinced of something different from what we believe at present. Anyway, I suggest that something like that be done; that we should not deal with this question on such short notice.

MR. HERRIOT: At a little gathering that we had for luncheon today I was laying down the law in a rather forcible manner to Mr. Pierce, Mr. Norrish and our worthy President. I was following the lines suggested by Mr. Hawkins just now—the organization of a Commission, as Mr. Plunkett suggested, that would correlate all the surveying and engineering branches in order to prevent overlapping. The Engineering Institute has recently taken steps to create a Committee to get in touch with Committees from other engineering, scientific or technical organizations for the furtherance of their own interests. We might take a leaf out of their book, appoint a Committee, and instruct it to communicate—or the Secretary might be instructed to communicate—with every other branch of the Government that is carrying on scientific or technical work in surveying or engineering. These branches might be asked to form similar committees, and these committees, working together, might be able to formulate some plan that would be workable. At present we have no solution; no scheme that would be workable.

MR. NORRISH : If we adopted that suggestion as outlined, nothing would be done this year; in any case, legislation would be necessary, for I doubt whether the necessary action could be taken by Order in Council. It is a matter for at least a year's consideration; we might get ahead at our next annual meeting. If we express ourselves to the Executive as being in favour of the appointment of a strong Committee to take the matter up along the lines suggested by Mr. Herriot, they might, during our absence in the field, get somewhere with it. The collection of a good deal of information will be necessary in order to show where there has been duplication. We should have a strong committee, good speakers, men who have the thing at their fingers' ends, who will take the matter up with the Cabinet or some member of the Cabinet. A good deal of time will be required. Perhaps the Executive could handle it after giving it consideration.

THE CHAIRMAN : The loss is not so much through the overlapping of work as through the expending by the different branches of energy in fighting each other instead of carrying on the work.

MR. SEIBERT : We cannot hope that the Department or the Government will move until men who know the conditions as we know them do something. Legislation is nearly always the result of the initiative of people who are directly interested. Perhaps Mr. Herriot's suggestion is a good one; at least somebody should be slated to look after this matter, because "what is everybody's business is nobody's business." That Committee could possibly accomplish a good deal by asking other societies to meet them. We have done something even by bringing this discussion up; those who have expressed themselves here have no doubt done so upon good grounds and quite sufficient reasons.

MR. McELHANNEY : I do not think that we can get any further with this discussion now. It seems to me that it is a matter for the Executive.

THE CHAIRMAN : I did not expect that we would do anything more than discuss the matter; but if nothing was said here the Executive might not think of taking it up at all. Now that we have discussed it at this meeting, I am sure that our Executive for the ensuing year will give it suitable consideration.

We are now to have a paper by Mr. Berry.

FIELD SURVEY TROOPS.

—BY—

E. W. BERRY, D.L.S.

In the warfare of positions it became necessary to have large scale maps showing minute detail as a key to the tangled maze of trenches and other defence works. The development of aerial photography made it possible to secure the necessary information. The modern practice of artillery firing from concealed positions at unseen targets was only possible when the required data were available for orienting and ranging the guns. These were among the reasons for the formation of the field Survey Troops. At first there was a company attached to each of the five British armies. These were later increased to battalion strength. Each company consisted of four groups—viz. (1) Draughtsmen, Photographers, Lithographers, etc.; (2) Topographers, (3) Flashspotters, (4) Sound rangers. A sketch of the various duties of each group follows, but first it is necessary to refer to the maps supplied by the Ordnance Survey which were the basis of all field work. These were divided into two classes—small scale, under 1/40,000, and large scale 1/40,000 and over. The small scale maps were on scales of six miles to an inch with relief shown to hundred metre intervals by layers of colour, 1/250,000, with 50 metre contours, and 1/100,000 with contours at intervals of 10 metres. The small scale maps showed clearly all routes by rail and road and the quality of these. They also contained a good deal of detail of towns and villages and other features. It is with the large scale maps, however, that we are chiefly concerned. The latter were issued on scales of 1/40,000, 1/20,000 and 1/10,000. The area covered by Belgium and Northern France is plotted on Bonnès projection. The central meridian passes through Brussels (Longitude E. 2° 02′ 4″.03 East of Paris) and the standard parallel is 50° 24′ north. The map is divided into sheets 32 Kilometres by 20 Kilometres in the case of the 1/40,000 scale. The sheet edges are respectively parallel and perpendicular to the meridian of Brussels. At the corner of each sheet are printed the distances of the sheet lines from the origin. For purposes of reference, the sheets are divided into rectangles by grid lines parallel to the sheet edges. The larger divisions represent 6000 yards by 5000 yards in the case of the northern and southern tiers of a sheet and 6000 yards square for the two central tiers, and are designated by the capital letters A to X successively from the N.W. to the S.E. of the sheet. These lettered divisions are further subdivided into squares of 1000 yard sides, numbered 1 to 30 for the rectangles A to F and S to X, and 1 to 36 for the two central rows of squares. The thousand yard squares are split by dotted lines, into quarters designated a.b.c.d. respectively. The capitals and numbers are printed on the map, but the small letters are usually omitted. Any point was described by its distance east and north of the S.W. corner of the smallest subdivision in units of 1/100 of the side of one of these squares—i.e. 5 yards Thus a point referred to as "K.16.d.25.02." would be 125 yards east and 10 yards north of the S.W. corner of S.E. ¼ of Section 16, square K. As the grid system measured 35,000 yards by 22,000 yards, there was some overlap around the sheet edges. The area covered by one sheet on a scale of 1/40,000 was represented by four sheets on the 1/20,000 scale, the same areas being indicated by the same grid notation in every case. As the meridians and parallels of Bonnès projection are curved lines, it follows that the difference between true and grid north increases with the distance from the origin. Everything was referred to grid bearings, however, so this caused no inconvenience. Lists of rectangular co-ordinates, referred to the origin of the projection, of points that had been fixed trigonometrically either before or during the war, were also furnished to the survey troops. These were in metres. For convenience in converting metre co-ordinates to grid co-ordinates, conversion tables were used, one table giving the metre co-ordinate of each line of the grid, and a further table reducing the residue in metres to decimals of a square side. The material used in compiling the maps seems to have been collected from various sources. Among these were French civil and military maps, cadastral maps prepared by the communes, and the plans and surveys of canals, railways, and mining areas. A large part of the field was also resurveyed by the British.

Draughtsmen, etc.

At the headquarters of the Field Survey Company was located a complete organization for producing maps. The ordnance maps were over-painted in colours with the latest information secured from every available source. Aeroplane photographs furnished the means of plotting details of the trenches with great accuracy. The flash spotters and sound rangers reported daily the positions of active enemy batteries. Intelligence was received from kite balloons and other observers. Photographical experts of the field survey company, either working at headquarters or attached to an aerodrome produced the ''mosaics'' and other prints. New information secured from these was transferred to the map by the ''camera lucida''. Special maps were prepared for the different branches of the service emphasizing only the particular features required. Thus, the counter battery map issued twice a month showed which hostile gun positions had been active, and which silent during the previous fortnight. The harassing fire map brought out distinctly the main arteries of traffic used by the enemy. The organization map gave the locations of trenches, aerodromes, dumps of ammunition, provisions and material, hospitals, etc. The bulk of this work was done by men who had formerly been achitectural draughtsmen, and the results were admitted by enemy literature to be superior, in accuracy and clearness, to anything produced on the German Side.

Topographers.

The principal duty of the topographers was to determine, by surveys on the ground, the map locations of battery positions for the artillery, and of observation posts, and reference points for the artillery, flashspotters and sound rangers. In the case of observation posts this was always done by resection or the ''three point problem''. It was the most accurate method available, because it was usually impossible to occupy a trigonometrical station, and it would have been highly impolite to have erected, at the point whose location was desired, a signal sufficiently conspicuous to admit of intersection from two such stations. The primary reference points were church spires, head works of mines and similar prominent land marks whose position was given in the lists of metre co-ordinates previously mentioned in connection with the ordnance maps. The instrument generally used was a "Mark V" director, an "observation of fire" instrument, a French or a captured German instrument of similar type. The characteristic differences between all these military instruments and a theodolite are that all the graduations are on the upper plate and instead of a vernier there is a fixed tangent screw with a graduated drumhead at the zero point on the lower plate. The threads of this screw engage teeth on the edge of the upper plate arranged so that a complete revolution of the drum moves the telescope one degree in azimuth. Degrees are read on the upper plate and minutes on the drum. There is a lever to disengage the tangent screw from the upper plate for reading large angles. The following is the reduction of a survey of an observation post, showing the amount of calculation involved.

Data—

From list of Metre co-ordinates:—

(A) Fosse 14, Fouquières Puits	W 103908.5	N.4079.1
(B) Factory Chimney, Brebières	W 96184.6	S.6138.3
(C) Bailleul, Highest point of ruins of Church	W 107989.4	S.5678.8

Angles read at observation post (P).

(a) A to C .... 49° 48′. (b) C to B .... 11° 56′

(See diagram—figure 1.)

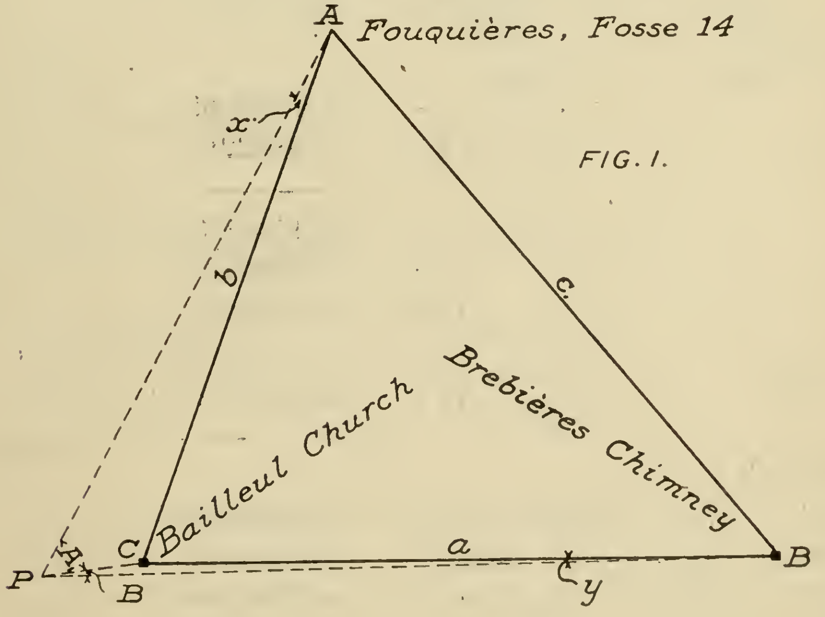

FIG. 1.

Formulae.

$(x + y) = C - (A + B)$

$\tan \frac{1}{2} (x - y) = \tan \frac{1}{2} (x + y) \tan (T - 45°)$

$\tan T = a \sin A / b \sin B$

Solution of bearings and sides of triangle A.B.C.

(Side b.)

Log	4080.9	=	3.6107560	
"	9757.9	=	3.9893564	
L tan	22°41′43″	=	9.6213996	(Bearing b.)
Log	9757.9	=	3.9893564	
L cos	22°41′23″	=	9.9649976	
Log	10576.9	=	4.0243588	(Length b.)

(Side a.)

Log	11804.8	=	4.0720292 x	
"	—459.5	=	2.6622855 –ve.	
L tan	92° 13′45″	=	11.3097337 –ve	(Bearing a.)
L sin	92° 13′45″	=	9.9996712 x	
L	11812.9	=	4.0723580 x	(Length a.)

(Side c.)

Log	7723.9	=	3.8878366	
"	–10217.4	=	4.0093404 x –ve	
L tan	142°54′44″	=	9.8784962 –ve	(Bearing c.)
L cos	142°54′44″	=	9.9018480 x	
Log	12808.8	=	4.1075084 x	(Length c.)

∴ A = 59°46′51″

B = 50°40′59″

C= = 69°32′02″ and

(A+B) = 61°44′

∴ (x+y) = 7°48′02″

½ (x+y) = 3°54′01″

Auxiliary Angle O.

Log a	=	4.0723580
L sin 49°41′	(A)	9.8822285
		13.9545865
Log b	=	4.0243588
L sin 11°56′	(B)	9.3154947
L tan 76°21′08″	(T)	10.6147330

Angles (X and Y)

L tan 3°54′01″	([½ (x+y)]	8.8336443
L tan 31°21′08″	(T–45°)	9.7848017
L tan 2°22′43″,	[½(x –y)]	8.6184460

∴ x = 6°16′44″

y = 1°31′18″

Solution of triangle A.P.B. for side P.A.

A.P.B. = (A + B) = 61°44′
P.A.B = (A + x) = 66°03′43″
P.B.A. = (B + y) = 52°12′17″
P.A. = c. sin (B+y)/sin (A+B)
Log 12808.8 (c) = 4.1075084
L sin 52°12′17″ = 9.8977401

14.0052485
L sin 61°44′ = 9.9448541

L 11492. (P.A.) = 4.0603944
Grid bearing C A = 22°41′43″

Angle x = 6°16′44″
∴ Grid bearing P.A. = 28°58′27″
Latitude and Departure A to P.
Log 11492 = 4.0603944
Log sin 28°58′27″ = 9.6852177
Log cos 28°58′27″ = 9.9419278

Log 5566.9 = 3.7456121
Log 10.053.9 = 4.0023222

Metre co-ordinates of A	=	103908.5 W	4079.1 N.
Lat. and dep. A. to P	=	5566.9 W	10053.9 S.
Metre co-ordinates of P.	=	109475.4 W	5974.8 S
* “ “ E. By.B.20.d		109601.2 W.	
* “ “ S. By.B.20d			6360.2 S.
Differences (Metres)		125.8	385.4
* Differences in terms of sides of a map square.		0.28	0.84

Information required:—
Map location of Observation Post = B.20.d. 28.84.
Bearings to—
Fosse 14 — Fouquieres = 28°58′27″
Bailleul Church = 78°46′27″
Brebieres Chimney = 90°42′27″
* (From tables).

For long range guns the position of a reference point or aiming post was determined in the same way with a surveyor's transit, and the distance and grid bearing from this point to the pivot gun were measured. In the case of field batteries the locations were usually obtained by reading the angles with a box sextant and the solution was made graphically, if time did not permit working it out analytically. The plane table was also extensively used for the positions of the shorter range guns. Sometimes, in the case of forward positions, all trigonometrical points in the vicinity had been obliterated; the location had then to be obtained by a traverse with plane table and tape, or by some other device. The accurate survey of battery positions was especially important in case of heavy concentration of artillery for a surprise attack. Under such circumstances, it was obviously impossible to use the older method of registering the guns by trial shots. The positions were usually surveyed and marked with stakes the day before the guns were brought up. In reference to the work of one field survey company, the following may be quoted from the published report of Lord Cavan's despatch of Nov. 15th, 1918, from Italy:—

"Par. 13.—At 11.30 on the night of Oct. 26th, the bombardment of hostile positions opened along the whole front. The fact that no single British gun had opened previous to this hour deserves special mention. Both heavy and field artillery were registered by the 6th, Field Survey Section, R.E., and the fact that the bombardment and the subsequent barrage were excellent in every way reflects the greatest credit on all ranks of this company."

Flash Spotters.

The flash spotting group determined by the method of intersection, the position of enemy batteries and other targets. Each group consisted of four or five observation posts placed at intervals along a front of some four miles and a central plotting station usually some distance in the rear of the line of posts. An observation post was usually situated in a trench. It consisted of a small rough hut of wood and galvanized iron with a shelf for the instruments and a slot in front to observe through. The essential equipment comprised a Mark V director or other instrument reading to minutes, a pair of binoculars graticuled in half degrees, and direct telephonic communication with the plotting officer. In addition to the usual crosshairs, the telescope of the director was provided with vertical wires spaced to cover intervals of 5 and 10 minutes. Its field was about one degree. By means of the graticules, the angular distance, right or left of the instrument' setting, of any gun flash appearing in the field of the telescope could be estimated. This was added to or subtracted from the H. C. R. as the case required. The diaphragm and horizontal circle were provided with small electric lights and another small electric light controlled by a switch from the observation post was placed on a picket some distance in front for checking the orientation of the instrument at night. In connection with the telephone was a push button which operated a buzzer and lit a lamp in the central station.

The equipment of the plotting office was a large scale grid mounted on a table, covering the same front as all the posts. On this the position of every post was marked by a small hole. Centred on these holes graduated arcs were drawn for reading grid bearings from the several posts. A silk thread was passed through every hole and a weight underneath kept the string taut and that on top of the table could be moved to place the string on any bearing required. The central station in addition to its connection with the posts had direct telephone communication with the counter battery officer and the Intelligence Branch.

The procedure of operation was as follows: Each post was manned day and night by two observers. As soon as the instrument was properly oriented by means of the data supplied by the topographer, a rough sketch panorama was made of the visible country. On this bearings to prominent marks at intervals of about 5° (the field covered by the binoculars) were noted. By reference to these points one observer with the graticuled glasses could give the other at the director a sufficiently accurate estimate of the bearing of an observed gun flash to bring it into the field of the telescope. The next round fired would find the director trained on the battery, and the grid bearing would be telephoned to the plotting office. By manipulating the threads on the plotting board, the operator would ascertain the approximate bearing of the enemy gun emplacement from the other posts, and warn them to look out for flashes in these directions. Then all the posts being on the alert, every observer would press his button on seeing a flash. If the connected electric lights at the plotting office came on simultaneously it was known that all posts were observing the same flash. The various bearings were then telephoned to the plotting officer where the position was fixed by intersection, the map co-ordinates scaled off the grid and immediately communicated to the counter battery officer, and Intelligence Branch. In this work speed was of the utmost importance, as very often only a few rounds would be fired at a time especially when ranging shots were being fired to register a gun in a new position. Besides gun emplacements any other objects whose positions were required for any purpose could be located in this way. Every morning when enemy captive balloons went up their positions were reported. The posts were also used for observing destructive shots by our own heavy artillery, the battery commander being given the co-ordinates of each shell burst within a few seconds of the time it landed.

Sound Rangers

The methods mentioned above are effective in clear weather. In France and Belgium, however, there are days and weeks together when such a system is rendered useless by fogs. Various devices were also used to screen and blanket gun flashes. It was for these reasons that sound ranging was introduced. The writer has no personal knowledge of the British system, but had access to some of the enemy literature on the subject when billeted in the "Artilleriemessschule" at Wahnerheide after the armistice. The methods used on our side are believed to have been much the same. The fundamental principle is this :If the report of a gun reaches a point, A, at a certain time and a point, B, sometime later, the positions of A and B being known, the difference between their distances from the unknown gun opsition can be determined by multiplying the difference in time by a constant for the speed of sound We have thus the data for plotting an hyperbola of which A and B are the foci. The gun position will lie on this locus. The equation to the curve will be $4x^2/A^2 - 4y^2/D^2 - d^2 = 1$, D and d being respectively the distance between the posts and the difference between the distances of the unknown from each post. If the same process be repeated with respect to B and another known point, e, a second hyperbola is found and the gun position is fixed by the intersection of the two. The equations to the hyperbola could, of course, be solved simultaneously in each particular case. In practice this would take too long, as a result to be of any use had frequently to be obtained almost instantaneously. The positions of the posts were therefore laid out on a plotting board similar to that used for flash spotting. On this were plotted a series of hyperbolas in different colours for posts taken in pairs, and for distances corresponding to differences of time from zero up to the limit required at intervals of 0.5 seconds. For 0 of course the locus is a straight line. Certain corrections had to be made for atmospheric conditions and for wind. A sound ranging headquarters could always be recognized by the presence of wind guages and other meterological instruments. Various methods were used in measuring differences of time such as stop watches and chronographs. Most of these required the presence of an observer at each post and telephone communication between the posts. The following method, however, did not require the posts to be manned, and electrical connection with the central station, only, was necessary. At each post was installed a microphone similar to a telephone receiver. The vibrations caused by sound waves oscillated a disk in this apparatus, making and breaking an electrical circuit momentarily. The wire of the circuit was lead to the central station. Here a loop of the wire was suspended between the poles of a permanent horse shoe magnet. On this loop was attached a mirror about the size of a pinhead. This was illuminated by an electric lamp and reflected a ray of light on to a strip of sensitized photographic paper which was moved by clockwork. So long as no current passed through the wire, the ray of light traced a straight line. When, however, the microphone was disturbed by sound waves, the loop of wire momentarily assumed the properties of a magnet and was deflected by the attraction and repulsion of the poles of the permanent magnet and an irregular zigzag line on the paper was produced. The records of three or more posts were made simultaneously on the same strip of paper. To make it possible to measure the differences of time another microphone was connected to a tuning fork which vibrated exactly 50 times in a second, and consequently traced a continuous saw tooth line with points registering 1/50 second. The resulting record is shown diagramatically in figure 2.

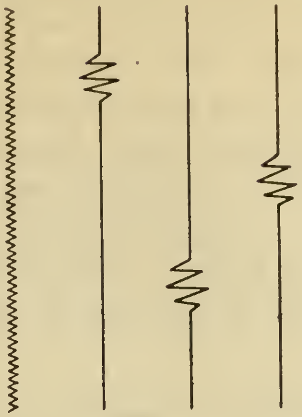

FIG. 2.

An observer well in front of the posts was stationed to notify the operator by telephone to start the apparatus at the plotting office. As soon as a gun report was recorded the sensitized paper was developed, and the differences of time scaled. The map location was then obtained by interpolation between the plotted hyperbolas on the board.

In March 1918, Canadians who had been attached to English units were recalled to the Corps, and a Canadian Corps Survey Station was formed. Previously there had been a force of draughtsmen and a few topographers connected with the Intelligence Branch. These were incorporated in the Corps Survey Section. A flash spotting group was organized. There was no sound ranging group in the Canadian Unit. Among the personnel were some provincial Land Surveyors, members of the staff of the Geological Survey and other technical branches of the Dominion Government besides the following Dominion Land Surveyors: M. D. McCloskey, W. A. Fletcher, A. M. Perry, O. Inkster, E. W. Berry. Mr. Inkster was awarded a Military Medal for gallant work under shell fire.

THE CHAIRMAN: Mr. McCloskey was a member of the corps mentioned by Mr. Berry. He will take up the discussion of this paper.

Mr. McCLOSKEY: I listened with pleasure to Mr. Berry's paper. I was impressed by the fact that he handled the subject very thoroughly; he is to be congratulated upon his effort. He refers to the "Field Survey Company", which is a war establishment of the army and therefore has no connection with the Canadian corps. He has, however, referred to the Canadian corps survey section, as follows:

> "In March, 1918, Canadians who had been attached to English units were recalled to the corps and the Canadian Corps Survey Section was formed. Previously there had been a force of draughtsmen connected with the Intelligence Branch."

There were some members of the Canadian corps attached to Imperial units—a small number; and while they were there they were employed as general observers. These men were recalled, but the fact that they had been attached to other units and were recalled had no significance whatever in the formation of a Canadian corps. In quoting Lord Cavan's despatch from Italy with regard to the bombardment on the 26th of October, the writer brings forward very clearly the great part played by the Survey Section in the artillery preparations. This work was exploited very successfully by the Canadian corps on the 8th of August at the opening of the battle of Amiens.

MR. PALMER : Mr. Berry remarks that the German maps were not as accurate as ours. I remember that the only complete maps of the British light railway system in Flanders were a series of German maps captured after the battle of Passchendaele. Every railway salient was shown exactly in position, better than indicated on any map coming from our own side.

MR. DALY : Mr. Chairman, I move that the usual stipend be voted to our Secretary.

MR. BENNETT : I second the motion.

The motion was adopted.

MR. TEASDALE : I notice that while quite a few of the members were willing to do a lot of the talking, when there was any writing to do they passed it on to the Secretary. They were very good also in recommending that votes of thanks be extended to different members. I think that along with the small remuneration we give the Secretary, we ought to extend to him a hearty vote of thanks for the efficient way in which he has handled the business during the year.

THE CHAIRMAN : I have much pleasure in conveying to the Secretary the thanks of the Association for his efficient and conscientious work. (Applause.)

MR. HENDERSON: We have heard a lot of talk; we have listened to a good many speeches, but the few words spoken by Mr. Daly and Mr. Bennett were, perhaps, as pleasant as any that I listened to during these meetings. Of course, this is not a job that one takes for the sake of the remuneration. The work is very heavy; this last year it has been particularly heavy, at a time when my office duties were heavy also. However, it has been a pleasure, and has been made a pleasure by the co-operation of the councillors with whom I have been associated. Nothing of an unpleasant nature has occurred during the whole year, and I am sure that things will go just as well in the year that is before us. You will always find me willing to do my part as well as I can.

It seems to me that the Dominion Land Surveyors' Association is entering upon a new era; wonderful possibilities are opening out before it. From being a small, insignificant body, the Association bids fair, if things are carried on with vigour, to be within a short time a very important organization in this country. (Applause).

VOTE OF THANKS TO GENERAL CURRIE.

MR. HAWKINS : I have much pleasure in moving that this Association instruct the Secretary to forward a letter of thanks to General Sir Arthur Currie for the very excellent address which he gave us the other evening.

The motion was seconded by Mr. Herriot and carried unanimously.

MR. WAUGH : I beg to move that the thanks of the Association be tendered to Mr. Akins for the splendid way in which he has conducted these meetings.

The motion was seconded by Mr. LeBlanc and conveyed to Mr. Akins by the President elect, Mr. Seibert, amid applause.

This concluded the proceedings of the Thirteenth Annual Meeting.

THE CANADIAN PIONEER SURVEYOR

With your note book and your transit and your slender tape of steel,
Striding clear across a continent with sure, firm tread,
You have blazed the path of progress for the advancing commonweal,
For where progress marches after, you have led.

Intrepid brother to the wildness, you have tracked our ancient fastness
You have measured out its greatness in your stride,
You have searched for all its features, revealing all its vastness,
With your faith in old Polaris for a guide.

You have sweltered on the prairie 'neath the summer sun a simmering,
With the heat waves leaping round you all in silent glee,
Those phantom dancing demons that would send your pickets glimmering
Far away across a molten prairie sea.

You have waded through the marshes to the waist in turbid water
With boots like lead a-lagging with each step you'd plough
And your pack a-sagging sickly as the tump-line, growing tauter,
Drew the flaming welts of red across your brow.

You have shivered 'mid the snows as you stood in winter weather
A-waiting at your instrument to sight the line,
While a million frost-flakes filtered through the frigid air together
To the sighing of the breezes in the pine.

Yes, you've played a part in progress for an adolescent nation,
The vital part of pioneering you've been through—
May we who follow after, of each later generation,
Prove worthy of our legacy revealed by you.

R. C. PURSER, D.L.S.

LIST OF MEMBERS

Patron :

E. DEVILLE, LL.D., I.S.O., D.T.S., Surveyor General, Ottawa

Honorary President:

OTTO KLOTZ, D.Sc., D.T.S., Chief Astronomer, Ottawa.

Honorary Members:

R. H. CAMPBELL, Director of Forestry, Interior Dept., Ottawa.
HON. J. P. B. CASGRAIN, D.L.S., Senator, Ottawa.
J. S. DENNIS, D.T.S., Asst. to President of C.P.R., Montreal.
C. A. MAGRATH, D.T.S., Ottawa.
W. J. STEWART, Chief Hydrographer, Naval Service.
P. B. SYMES, Esq., Ottawa.

Past Presidents:

MAJOR. E. W. HUBBELL	1907-8
R. E. YOUNG	1909-10
T. FAWCETT	1911
P. R. A. BELANGER	1912
C. F. MILES	1913
C. F. AYLSWORTH	1914
A. H. HAWKINS	1915-16
J. J. McARTHUR	1917
J. N. WALLACE	1918
J. R. AKINS	1919

ACTIVE MEMBERS

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Akins, James Robert, B.Sc.	1910	1912	Topographical Surveys, Ottawa	108 Strathcona Ave., Ottawa
Alexander, John Bentley, B.Sc.	1914	1918	Thomas Block, Calgary	
Aylsworth, Charles Fraser, O.L.S.	1886	1907		Madoc, Ont.
Baird, Wilmot Johnston		1913		Scarborough, Ont.
Bannister, George William	1919	1920		482 Bronson Ave., Ottawa.
Barber, Herbert George, Grad. S.P.S.	1908	1910	Topographical Surveys, Ottawa	10 Thornton St., Ottawa.
Bartley, Thomas Holmes, B.A.Sc., O.L.S.	1913	1916	Topographical Surveys, Ottawa	Carleton Place, Ont.
Bayne, George A., M.L.S.	1872	1907	c/o H.B. Co. Winnipeg	
Beatty, Frank Weldon, Grad. S.P.S.	1914	1915	Topographical Surveys, Ottawa	Pembroke, Ont.
Benner, Frederick James King, O.L.S.	1915	1918		Port Arthur, Ont.
Bennett, George Arthur, Grad. S.P.S.	1910	1912	Topographical Surveys, Ottawa	Tillsonburg, Ont.
Beresford, Henry Edward, M.B.E., M.L.S.	1913	1914		Winnipeg, Man.
Beresford, Herbert Graham, M.L.S.	1915	1915		859 Ingersoll St., Winnipeg, Man.
Berry, Edward Wilson, Grad. S.P.S.	1911	1913	7 Thomas Block, Calgary	
Bigger, Charles Albert, O.L.S., B.C.L.S.	1882	1910	Geodetic Surveys, Ottawa	141 Cartier Street, Ottawa.
Blanchet, Guy Houghton, B.Sc.	1910	1911	Topographical Surveys, Ottawa	110 Frank Street, Ottawa.
Boulton, William James, Grad. S.P.S.	1912	1913	Topographical Surveys, Ottawa	
Bowman, Edgar Peterson, Grad. S.P.S., O.L.S.	1907	1912		West Montrose, Ont.
Bray, Samuel, O.L.S.	1883	1910	Chief Surveyor Dept. of Indian Affairs, Ottawa	229 Argyle Avenue, Ottawa.
Brenot, Lucien	1910	1910	Topographical Surveys, Ottawa	297 Clemow Avenue, Ottawa.
Bridgland, Morrison Parsons	1905	1910	7 Thomas Block, Calgary	1950-13 Street. W., Calgary, Alta.
Bruynseraede, Rene	1916	1917		Box 597 Red Deer, Alta.
Buchanan, John Alexander, Grad. S.P.S.	1912	1913	Topographical Surveys, Ottawa	10234-122nd Street, Edmonton,
Burgess, Edwin Le Roy, Grad. S.P.S., O.L.S., B.C.L.S.	1905	1907		Kamloops, B.C.
Calder, John Alexander	1912	1912		Ashcroft, B.C.
Cameron, Charles S.		1919		P. O. Box 150, Regina, Sask.
Cameron, M. G.		1919		441 Reid Street, Peterborough, Ont.
Cannell, Herbert William	1913	1913	Topographical Surveys, Ottawa	
Carson, John Alton, B.Sc., B.C.L.S.	1914	1917		1625-8th Avenue W., Vancouver.
Carthew, John Trewalla	1913	1913		Edmonton, Alta.

ACTIVE MEMBERS—Continued

NAME	Date of Comm.	Date of Admission to Assoc'n	HOME ADDRESS	HOME ADDRESS
Cautley, Richard William, A.L.S.	1896	1909	523-6th Street, Edmonton	Edmonton, Alta.
Chase, Albert Victor, Grad. S.P.S., O.L.S., A.M.E.I.C.	1910	1912		Orillia, Ont.
Christie, William, Grad. S.P.S.	1906	1917	Topographical Surveys, Ottawa	Prince Albert, Sask.
Christie, Gerald Moffat, B.C.L.S.	1917	1917		Kamloops, B.C.
Clarke, Roger Fyfe, B.Sc., M.C.	1914	1914		Vineland, Ont.
Clements, Frederic Simon, B.C.L.S.	1905	1912		Box 49, Prince Rupert, B.C.
Cleveland, Ernest Albert, B.C.L.S.	1899	1909	1001 Rogers Building, Vancouver	
Clouston, Noel S.	1915	1919		Ashmere, Orwell Road, Dublin, Ir'd
Clunn, Thomas Henry Gwyther	1908	1910	M.L. & Y. Br. Dept. of Int., Ottawa	119 Fentiman Avenue, Ottawa.
Cochrane, Morton Farrer, P.A.S.I.	1903	1909	Dom. Water Power Br. Dept. of Int., Ottawa	266 McLaren Street, Ottawa.
Coltham, George William, B.A.Sc., O.L.S.	1913	1913		Aurora, Ont.
Coltham, James Thomas, O.L.S.	1915	1918		Aurora, Ont.
Coté, Joseph Martial	1913	1913	Topographical Surveys, Ottawa	72 College Avenue, Ottawa.
Coursier, Eric C.	1916	1920		Enderby, B.C.
Cowper, George Constable, B.A.Sc., A.L.S., A.M.E.I.C.	1911	1912	Topographical Surveys, Ottawa	131 Fentiman Avenue, Ottawa.
Craig, John Davidson, B.A., B.Sc.	1902	1909	Boundary Surveys, Ottawa	593 Besserer Street, Ottawa.
Crouch, Milton Edwin, Grad. S.P.S., O.L.S.	1914	1916		Box 57, Nipigon, Ont.
Cumming, Austin Louis B.Sc., A.L.S.	1910	1910	Topographical Surveys, Ottawa	Cornwall, Ont.
Currie, Peter William, B.Sc.	1902	1907	Survey Records, Int. Dept., Ottawa	92 Argyle Avenue, Ottawa.
Daly, William Patrick	1916	1918	Topographical Surveys, Ottawa	88 Sunnyside Avenue, Ottawa.
Davies, Thomas Atwood	1906	1911	Topographical Surveys, Ottawa	
Deans, William James, O.L.S.	1886	1908		Brandon, Man.
de la Condamine, Oscar Charles, A.L.S.	1910	1910		Calgary, Alta.
Dennis, Earle Munro, B.Sc.	1908	1911	Topographical Surveys, Ottawa	64 Aylmer Ave., Ottawa.
Dennis, William Melbern, B.Sc.	1911	1912	Geodetic Surveys, Ottawa	261 Powell Ave., Ottawa.
Dickson, Henry Godkin	1889	1907		Whitehorse, Y.T.
Dillabough, James Vidal, B.Sc.	1910	1912		Drumheller, Alta.
Dodge, George Blanchard, M.E.I.C.	1909	1909	Topographical Surveys, Ottawa	12 Thomas Street, Ottawa.
Donnelly, Cecil B.C.	1913	1913		Winnipeg, Man.
Doze, Joseph Wilbert	1915	1915		Fort Saskatchewan, Alta.

ACTIVE MEMBERS

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Dozois, Leo Osward Ross, Grad. R.M.C.	1913	1913	7 Thomas Block, Calgary	Calgary, Alta.
Edwards, George, O.L.S.	1872	1909		Ponoka, Alta.
Elliott, George Reginald, Grad. S.P.S.	1913	1913		Calgary, Alta.
Engler, Carl, B.A.	1905	1907	Topographical Surveys, Ottawa	145 Powell Avenue, Ottawa.
Evans, Stanley Livingstone, Grad. S.P.S.	1911	1912	Topographical Surveys, Ottawa	Calgary, Alta.
Ewan, Hedley Jenkins	1914	1915		Yarmouth, N.S.
Ewing, Ernest Olliphant, Grad. S.P.S.	1908	1914		Toronto, Ont.
Fawcett, Adam	1893	1907	Topographical Surveys, Ottawa	Gravenhurst, Ont.
Fawcett, Thomas, D.T.S., O.L.S.	1876	1907	Boundary Surveys, Ottawa	7 Driveway W., Ottawa.
Fawcett, Sydney Dawson	1911	1914	Topographical Surveys, Ottawa	Toutes Aides, Man.
Finnie, Oswald Sterling, B.Sc.	1915	1915	M.L. & Y. Branch, Ottawa	221 Stewart Street, Ottawa.
Ferguson, George Hendry, M.C., Grad. S.P.S.	1909	1910	Conservation Commission, Ottawa	
Fletcher, James Allan, Grad. S.P.S.	1911	1911		Fletcher, Ont.
Fletcher, William Arthur, Grad. S.P.S.	1912	1915	Topographical Surveys, Ottawa	Barrie, Ont.
Fontaine, Louis Elie	1892	1907	Topographical Surveys, Ottawa	Levis, P.Q.
Francis, John	1875	1907		Portage la Prairie, Man.
Fredette, Joseph, Fredelin	1914	1919	Topographical Surveys, Ottawa	
Fullerton, James T.	1916	1919		Victoria, B.C.
Galletly, James Simpson, Grad. S.P.S.	1911	1911		Toronto, Ont.
Garner, Albert Coleman, S.L.S., D.S.O.	1911	1909	Chief Surveyor, Land Titles Office, Regina, Sask.	Regina, Sask.
Gibbon, James, Grad. S.P.S., O.L.S.	1891	1908		1631 Collingwood Street, Van.
Glover, Arthur Edward, Grad. S.P.S.	1911	1913	Topographical Surveys, Ottawa	12220 Stony Plain Rd., Edmonton.
Gorman, Arthur O.	1916	1919	Topographical Surveys, Ottawa	Buckingham, P. Q.
Gorman, Edwin Frederick	1915	1919	Topographical Surveys, Ottawa	Buckingham, P. Q.
Gourlay, Robert Murray, O.L.S.	1914	1914		97 Spencer Avenue, Toronto.
Grover, George Alexander, B.A. B.Sc.	1904	1907		157 Bay Street, Toronto.
Hamilton, Charles Thomas, Grad. S.P.S.	1911	1913	1038 Standard Bank Bldg. Vancouver	
Haggen, Rupert Williams, B.C.L.S.	1911	1911		Quesnel, B.C.
Hardouin, Joseph	1914	1914	Topographical Surveys, Ottawa	

ACTIVE MEMBERS—Continued

NAME	Date of Comm.	Date of Admission to Assoc'n	HOME ADDRESS	HOME ADDRESS
Harris, John Walter, O.L.S., M.L.S., M.E.I.C.	1872	1913	Assessment Commissioner and City Surveyor, Winnipeg, Man.	Winnipeg, Man.
Harvey, Charles, B.C.L.S.	1904	1910		Hamilton, Ont.
Hawkins, Albert Howard, B.C.L.S., B.A.Sc.	1906	1907	Topographical Surveys, Ottawa	Ottawa, Ont.
Heathcott Robert Vernon, P.A.S.I.	1906	1907	Militia Department	Ottawa, Ont.
Henderson, Francis Dillon, Grad. S.P.S.	1906	1907	Topographical Surveys, Ottawa	5 Woodlawn, Avenue, Ottawa.
Herriot, George Henry, B.Sc.	1909	1911	Topographical Surveys, Ottawa	2 Martello Apts., 625 Broadway Ave., Winnipeg, Man.
Heuperman, L.F.		1913		P.O. Box. 504 Salem.
Hobbs, Wilfred Ernest	1912	1912	Highway Com., Winnipeg, Man.	
Hopkins, Marshall Willard, O.L.S.	1901	1907	Chief Surveyor, Land Titles Office, Edmonton, Alta.	
Hotchkiss Cyrus, P.	1915	1919	Topographical Surveys, Ottawa	
Howe, John Parnell	1918	1919		Box 1030 Pembroke, Ont.
Hubbell, Ernest Wilson, Grad. R.M.C.	1884	1907	Chief Inspector of Surveys, Int. Dept., Ottawa	61 Russell Ave., Ottawa.
Inkster, Oluff, M.M.	1911	1911	Topographical Surveys, Ottawa	Edmonton, Alta.
Jackson, John Edwin, Grad. S.P.S., O.L.S.	1911	1917	Topographical Surveys, Ottawa	164 Cumberland Ave., Hamilton, Ont
Jephson, Richard Jermy, O.L.S., B.C.L.S.	1880	1909		Box 968 Brandon, Man.
Johnston, Robert Henry, Grad. S.P.S.	1913	1913		10016-108th St., Edmonton, Alta.
Johnston, William James, O.L.S., B.C.L.S.	1911	1911	Topographical Surveys, Ottawa	1816 Waterloo Road, Van., B.C.
Johnston, James Homer	1912	1912		Peace River, Alta.
Joslyn. Cecil Earl, B.Sc.	1916	1919	Imperial Munitions Bld., Toronto	
King, Arthur Harry	1916	1918	Topographical Surveys, Ottawa	Maitland, Hants, N.S.
King, John Albert Shirley, B.Sc., A.M.E.I.C.	1914	1915	Topographical Surveys, Ottawa	18 Broadway Ave., Ottawa.
Kitto, Franklin H.	1908	1911	Natural Resources Intelligence Branch, Int. Dept., Ottawa	99 Acacia Ave., Ottawa.
Knight, Richard H., Grad. S.P.S., A.L.S.	1904	1907	Topographical Surveys, Ottawa	10417-100th Ave., Edmonton, Alta.
Lamarque, Ernest Charles, B.C.L.S.	1917	1918		1606 Nelson St., Vancouver.

ACTIVE MEMBERS

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Lambart, Howard Frederick John, B.Sc.	1917	1918	Geodetic Surveys, Ottawa	7 Rideau Gate, Ottawa.
LeBlanc, Pierre Maxime Henri	1913	1913	Topographical Surveys, Ottawa	120 Wurtemburg St., Ottawa.
Lighthall, Abram, B.Sc., B.C.L.S.	1909	1911		2328 Vine St., Vancouver.
Logan, Robert Archibald	1914	1919		Midle Musquodoboit, N.S.
Lonergan, Gerald Joseph, Q.L.S., A.L.S.	1901	1907	Inspector of Surveys, Topographical Surveys, Ottawa	Buckingham, P.Q.
Lumb, William Ewart, B.Sc., O.L.S.	1914	1917		Bancroft, Ont.
Lumsden, Hugh D., C.E., O.L.S., M.I.C.E., M.E.I.C.	1872	1907		Orillia, Ont.
Lyon, John Edward, Grad. R.M.C.	1917	1917	Militia Department	Ottawa, Ont.
Macdonald, Colin Stone	1914	1917	Topographical Surveys, Ottawa	139 Stewart, Street, Ottawa, Ont.
MacIlquham, Walter Lloyd, B.Sc.	1913	1918	Topographical Surveys, Ottawa	41 Grove Avenue, Ottawa, Ont.
MacTavish, William Higgins, Grad. S.P.S.	1913	1917	Geodetic Surveys, Ottawa	323 Flora Street, Ottawa, Ont.
Martindale, Earnest Smith, Grad. S.P.S.	1911	1912	Topographical Surveys, Ottawa	Kingsmill, Ont.
Martyn, Oscar William, Grad. S.P.S., S.L.S.	1911	1912		Swift Current, Sask.
McArthur, James Joseph	1879	1909	International Boundary Commissioner, Ottawa	459 Gilmour Street, Ottawa, Ont.
McCaw, Robert Daniel, O.L.S., B.C.L.S.	1909	1912	35 Howe Street, Vancouver	
McCloskey, Michael D'Arcy, M.M.	1915	1917	Topographical Surveys, Ottawa	Chelsea, P.Q.
McCusker, K.F.		1916	Topographical Surveys, Ottawa	
McElhanney, Thomas Andrew, Grad. S.P.S.	1912	1919	Topographical Surveys, Ottawa	
McEwen, Duncan, Findlay, B.Sc., A.L.S.	1911	1912		Hensall, Ont.
McKay, Robert B., B.Sc., B.C.L.S.	1912	1912	Topographical Surveys, Ottawa	1348 Haro St., Vancouver, B.C.
McKnight, James Henry, Grad. S.P.S., O.L.S.	1913	1914	Topographical Surveys, Ottawa	Gravenhurst, Ont.
Meikle, McKay, B.Sc.	9916	1917		316 Daly Ave., Ottawa.
Melhuish, Paul, B.Sc., B.C.L.S.	1911	1912	Topographical Surveys, Ottawa	Vancouver, B.C.
Miles, Charles Falconer	1872	1907		Calgary, Alta.
Milliken, John Bolton, B.A., BSc.	1912	1913	Topographical Surveys, Ottawa	First Avenue, Ottawa, Ont.
Moberly. Harford Kenneth, Grad. S.P.S.	1903	1909		Yorkton, Sask.
Montogmery, Royal Harp, Grad. S.P.S., S.L.S. D.T.S.	1905	1909	7 Thomas Block, Calgary	Prince Albert, Sask.
Moran, Patrick Joseph, B.Sc.	1914	1914	Topographical Surveys, Ottawa	950 Jarvis St., Vancouver, B.C.
Morency, George Elie, Q.L.S.	1913	1914	Topographical Surveys, Ottawa	162 Wellington St., Hull, P.Q.

ACTIVE MEMBERS—Continued

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Morrier, Joseph Eldedge, A.L.S., S.L.S.	1907	1909		Prince Albert, Sask.
Murdie, William Campbell, Grad. S.P.S., M.C.	1916	1917	Geodetic Surveys, Ottawa	
Narraway, Athos Maxwell, B.Sc.	1911	1911	Controller of Surveys, Topographical Surveys, Ottawa.	159 Carling Ave., Ottawa.
Neelands, Abraham Rupert, Grad. S.P.S., M.C.	1912	1912		Hamiota, Man.
Nelles, Douglas Henry	1907	1909	Boundary Surveys, Ottawa	
Norrish, Wilbert Henry, B.Sc., O.L.S., A.L.S., A.M.E.I.C.	1914	1915	Topographical Surveys, Ottawa	
Ogilvie, Noel J.	1905	1910	Superintendent of Geodetic Surveys, Ottawa	96 Carling Ave., Ottawa.
Parry, Harry, B.E.	1905	1913	Topographical Surveys, Ottawa	220 Lisgar Road, Ottawa.
Palmer, Philip Ebenezer	1912	1912	Topographical Surveys, Ottawa	St. John, N.B.
Parsons, John Lindsay Rowlett, Grad. S.P.S., O.L.S., S.L.S., C.M.G., D.S.O.	1905	1910		Regina, Sask.
Patterson, John Herbert	1918	1918	Topographical Surveys, Ottawa	Kinosota, Man.
Patrick, Allan Poyntz, D.T.S., B.C.L.S.	1877	1910		Box 445 Calgary, Alta.
Pearce, William, O.L.S., B.C.L.S.	1880	1910	Natural Resources, C.P.R.	Calgary, Alta.
Pearson, Hugh Edward, M.C.	1912	1913		Edmonton, Alta.
Perry, Alfred Melville	1917	1917	Topographical Surveys, Ottawa	
Peters, Frederic Hatheway, Grad. R.M.C.	1910	1913	Commissioner of Irrigation, Calgary, Alta.	
Phillips, Edward Horace, Grad. S.P.S., S.L.S.	1902	1907	Land Titles Office, Regina, Sask.	Saskatoon, Sask.
Phillips, Edwin Percy Argall, Grad. S.P.S., O.L.S.	1916	1918		Port Arthur, Ont.
Pierce, John Wesley, O.L.S.	1909	1911	Topographical Surveys, Ottawa	Pembroke, Ont.
Pinder, George Zouch, M.C.	1913	1914		Manchester, Eng.
Plunkett, Thomas Hartley, Grad. S.P.S.	1908	1911		Meaford, Ont.
Purser, Ralph Clinton, Grad. S.P.S.	1911	1911	Topographical Surveys, Ottawa	211-5th Ave., Ottawa.
Rainboth, George Louis, O.L.S.	1910	1911	Boundary Surveys, Ottawa	Aylmer, P.Q.

ACTIVE MEMBERS—Continued

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Rannie, John Leslie, B.A.Sc., D.T.S.	1909	1916	Geodetic Surveys, Ottawa	9 Oakland Ave., Ottawa.
Read, Hiram Earle, B.Sc.	1917	1919	Topographical Surveys, Ottawa	Calgary, Alta.
Reilly, William Robinson, O.L.S., M.L.S.	1881	1907		Regina, Sask.
Rinfret, Claude, Q.L.S.	1908	1911	Topographical Surveys, Ottawa	178 Russell Ave., Ottawa.
Rice, Frederick William, B.Sc.	1908	1918	Topographical Surveys, Ottawa	578 O'Connor St., Ottawa.
Rimmer, William Bolton, B.Sc., B.C.L.S.	1916	1918		Westmorland, Eng.
Robertson, Donald Fraser, Grad. S.P.S.	1909	1913	Indian Affairs Dept., Ottawa	291 Wilbrod St., Ottawa.
Robinson, William Earl, Grad. S.P.S.	1914	1918		Oshawa, Ont.
Rolfson, Orville, Grad. S.P.S., O.L.S.	1908	1909	Topographical Surveys, Ottawa	Walkerville, Ont.
Ross, George, B.A.Sc., O.L.S.	1882	1907		Welland, Ont.
Ross, Joseph Edmund, O.L.S., B.C.L.S.	1891	1910		Kamloops, B.C.
Roy, George Peter	1881	1907		28 Lachevrotiere St., Quebec.
Saunders, Bryce J., B.A.Sc., O.L.S.	1884	1909		Edmonton, Alta.
Seager, Edmund, O.L.S.	1872	1809		Kenora, Ont.
Segré, Beresford Henry, Grad. S.P.S.	1812	1912		Toronto, Ont.
Seibert, Frederick Victor, Grad. S.P.S.	1811	1912	Topographical Surveys, Ottawa	10741-126th St. Edmonton, Alta.
Seymour, Horace Flewellyn, B.A.Sc., O.L.S., A.L.S., P.L.S.	1606	1910	Housing Committee of the Cabinet, Ottawa	Aylmer, P.Q.
Shanks, Thomas, B.A.Sc.	1902	1907	Asst. Surveyor-General, Topographical Surveys, Ottawa	Laurentian Club, Ottawa.
Shaver, Peter Albert	1914	1914	Topographical Surveys, Ottawa	Finch, Ont.
Shaw, Charles Æneas, O.L.S., B.C.L.S.	1880	1910		Greenwood, B.C.
Sibbett, William Algernon, Grad. S.P.S., O.L.S.	1916	1918		Bracebridge, Ont.
Speight, Thomas Bailey, O.L.S.	1882	1907	703 Temple Building, Toronto	
Spence, Wm. Archibald	1916	1920		159 Centre St., Ottawa.
Soars, Henry Martin Robinson	1908	1912	Topographical Surveys, Ottawa	1117-91st Ave., Edmonton, Alta.
Steele, Ira John, Grad. S.P.S., O.L.S.	1908	1909		Lloydminster, Sask.
Stewart, Alexander George, B.Sc.	1910	1912	Dept. of Public Works, Alberta	Edmonton, Alta.
Stewart, Norman Charles, Grad. S.P.S., B.C.L.S.	1912	1912	Topographical Surveys, Ottawa	Burnaby Lake, B.C.
Stewart, William Malcolm, Grad. S.P.S.	1907	1911		Saskatoon, Sask.
Stewart, Allan Douglas	1916	1917	Natural Resources Intelligence Br., Int. Dept., Ottawa	251 Clemow Ave., Ottawa.

ACTIVE MEMBERS—Continued

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Stock, James Joseph, M.C., Grad. S.P.S.	1910	1913	Topographical Surveys, Ottawa	Ottawa, Ont.
Stuart, Alexander Graham, B.Sc.	1911	1911		Aimes, Iowa.
Tassie, Gilbert Culloden, B.C.L.S.	1917	1917		Golden, B.C.
Taylor, William Emerson, Grad. S.P.S., O.L.S.	1910	1914		323 Glen Road, Toronto.
Taggart, Charles Henry	1911	1911	Topographical Surveys, Ottawa	Kamloops, B.C.
Teasdale, Charles Montgomery, Grad. S.P.S.	1906	1908		36 Churchill Ave., Toronto.
Tobey, Wilmot Maxwell, M.A., D.T.S.	1906	1912	Geodetic Surveys, Ottawa	96 Second Avenue, Ottawa.
Tyrrell, James Williams, C.E., O.L.S.	1887	1907	7 Hughson St., S. Hamilton, Ont.	
Underwood, Joseph Edwin, Grad. S.P.S.	1911	1911	605 Canada Bldg., Saskatoon, Sask.	
Van Skiver, Leighton Adelbert	1913	1913		Pickering, Ont.
Waddell, William Henry, O.L.S.	1907	1913		Edmonton, Alta.
Walker, Claude Melville, Grad. S.P.S.	1911	1911	Topographical Surveys, Ottawa	Banff, Alta.
Warrington, George Arthur, Grad. S.P.S., M.L.S.	1913	1914	Public Works, Winnipeg	
Waugh, Bruce Wallace, Grad. S.P.S.	1912	1913	Topographical Surveys, Ottawa	
Weekes, Abel Seneca, O.L.S.	1892	1907		9528-106th Ave., Edmonton, Alta.
Whitcher, Arthur Henry	1872	1912		315 Frank St., Ottawa, Ont.
Whyte, Harold Eustace, B.Sc., B.C.L.S.	1912	1912		536 Linden Ave., Victoria.
Wight, Edmund James	1915	1917	Topographical Surveys, Ottawa	Woodroffe, Ont.
Wing, Daniel Oscar, Grad. S.P.S., B.C.L.S.	1917	1918	Topographical Surveys, Ottawa	St. Johns, Que.
Wright, James Goldwin		1918	Topographical Surveys, Ottawa	Westboro, Ont.

Deceased Members

Name	Date of Death
BOLTON, L. E. S	June 13, 1916. Killed in action.
BRADY, J.	
CARTHEW, W. M.	June, 1916. Killed in action.
EARLE, W. S.	April, 2, 1916. Killed in action.
EDWARDS, PROF. W. M.	Nov. 19, 1918.
GASS, L. H.	April 8, 1917. Killed in action.
GORDON, M. L.	1917., Killed in action.
GREEN, W. T.	Nov. 1, 1909.
HUNTER, A. E.	July 14, 1914. Drowned.
HOLCROFT, H. S.	1916. Died on active service.
JOHNSON, C. E.	Dec. 31, 1913.
KING, DR. W. F.	April 23, 1916.
LEMOINE, C. E.	1917.
McFADDEN, M.	1918.
McLEAN, J. K.	May 25, 1913.
MACKIE, F. H.	Dec. 23, 1912.
OGILVIE, W.	Nov. 13, 1912.
PONTON, A. W.	Jan. 21, 1915.
RATZ, W. F.	Feb. 6, 1909.
RAINBOTH, G. C.	Nov. 2, 1910.
REID, J. L.	June 18, 1911.
ROBINSON, E. W.	Aug. 4, 1916. Drowned.
ROY, J. E.	Nov. 10, 1918.
SCOTT, W. A.	Aug. 12, 1919.
SELBY, H. W.	Aug. 23, 1910.
SIROIS. J. E.	Oct. 10, 1919.
STACEY, A. G.	June 4, 1908.
STITT, O. M., M.C.	Aug. 16, 1918. Killed in action.
TREMBLAY, A. J.	1918. Killed in action.
YOUNG, R. E.	Oct. 24, 1911.

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EDMONTON ALBERTA

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CATALOGUE ON REQUEST

ANNUAL REPORT

— OF THE —

Association of Dominion Land Surveyors

Together with the

Papers Read At The

Fourteenth Annual Meeting

— Held at —

OTTAWA

on the 2nd 3rd and 4th February, 1921.

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G. H. BLANCHET, D.L.S.
President D.L.S. Association, 1921.

ASSOCIATION OF DOMINION LAND SURVEYORS

FOURTEENTH ANNUAL MEETING

The Fourteenth Annual meeting of the Association of Dominion Land Surveyors was held at the Ottawa Public Library, February 2nd, 3rd and 4th, 1921.

Wednesday, February 2nd—Morning Session.

The meeting was called to order by the President, Mr. F. V. Seibert, who called upon the Secretary-Treasurer to read the minutes of the last Annual Meeting.

MR. HENDERSON : The proceedings of the last Annual meeting were printed and distributed to the members as our Thirteenth Annual Report. The members have these in their possession, and I beg to move that the minutes as recorded in this Report be received and adopted.

The motion was seconded by Mr. J. R. Akins, and carried.

President's Address.

The President in welcoming the members to the Fourteenth Annual Meeting of the Association expressed his pleasure at the evident progress of the Association, as shown by the increased membership in the Association, the large number present at the opening of the Annual Meeting, and the added interest in the proceedings. He then referred in feeling terms to the passing of one of the oldest and ablest of the members, Mr. Thomas Fawcett, D.T.S.

Continuing, his address was, throughout, an inspiring call for still higher and better service to their country from the members of the Association.

In referring to the objects, attainments and successes of the Surveyors and their Association, and in dealing with the status of the profession in relation to industrial and social activities, he spoke in part as follows:

"We, as a body of professional men, will not fill our proper place and fulfil our moral obligations until we have each and all applied ourselves, not only to our own professional responsibilities, but also to those broader and more vital social and national problems that confront us, and which the Surveyor from his particular kind of training is well fitted to assist in solving. The analytic and constructive qualities of the Engineer are very necessary in the world to-day, and particularly so in the solution of these problems......... The point of view of the Surveyor is an additional qualification. Only he who lives close to nature and spends long periods away from our highly organized life can appreciate the perspective that the Surveyor obtains. There is such a thing as being too close to a problem, and there is such a thing as being too far away. The Surveyor with his six months in the field and an equal period in civilization, experiences a happy medium, and on that account should be a very helpful stabilizing force in the community. . . . . . It is my firm conviction that our profession as a whole is not living up to its responsibilities. Too many of our members have no interest in life outside of their profession. It is true that the conditions under which we work, the lack of sequence in our life, the difficulty of keeping in touch with affairs outside our own professional activities, and the effort necessary to overcome these conditions all tend to keep us to ourselves and to make us become very individualistic, but that very effort, which if persevered in, finally overcomes these difficulties, is not wasted, but gives additional strength to our personality, and a new interest to our life. Everything in life that is done for itself alone is narrow. It is only when it is co-ordinated and correlated with the other activities that it reaches its real significance and its greatest value. The many qualities that go to make a successful Surveyor—integrity, concentration, judicial capacity, definiteness of purpose, keen observation, resourcefulness, to name only a few—are largely lost if used only for the carrying out of his professional duties. He should use these same qualities in taking his share of our many complex problems and obligations. Failing that, he is not living up to his opportunities or doing his duty, and not only is the world losing much that is necessary to its successful advancement, but the Surveyor himself is suffering a very serious loss which is all the more regretable in that it is largely from his own choice or neglect. . . . . Our problems of reconstruction are more spiritual than material. They pertain more to the individual than to things. The basis of such reconstruction lies in the nobility of character of the human being, and if we are to have a change for the better we must have an underlying feeling of a sense of responsibility to each other and to the whole world. . . . . The outlook to-day for those who work with their hands seems reasonably assured, but on the other hand for the brain workers it is uncertain. For the man who works with his brain, his hands and his feet, who must be proficient both practically and theoretically, both physically and mentally, and who throws himself wholly into his work, sacrificing himself and family to a most marked degree, as does the Surveyor, the situation is none too satisfactory. In spite of this, however, we should not be discouraged, for after all, work is its own best reward, even if it does not pay the grocery bills. That which we receive is important, but more important is that which we do, and most important of all is the kind of man who does it. The success of life should not be measured by the amount of money acquired, although we as Surveyors would desire and feel justified in demanding sufficient to keep us in our old age when we can no longer carry on our arduous tasks. The successful, however, are those who have done the most for the world, and measuring ourselves by this standard, we have no need to feel ashamed. . . . . . . ”

THE CHAIRMAN : We will now have the report of the Secretary-Treasurer.

REPORT OF THE SECRETARY-TREASURER

The Executive Council held thirteen meetings during the year. The personnel was as follows :

President . . . . F. V. Seibert.
Vice-President · G. H. Blanchet.
Secretary . . . . F. D. Henderson.

Councillors for Ottawa.

W. J. Boulton.
F. H. Kitto.
T. A. McElhanney.
D. H. Nelles.
B. W. Waugh.

Councillors for Quebec and Maritime Provinces.

H. L. Seymour.

Councillors for Ontario.

A. L. Cumming.
J. W. Pierce.

Councillors for Manitoba.

H. E. Beresford.
A. R. Neelands.

Councillors for Saskatchewan.

J. L. R. Parsons.
E. H. Phillips.

Councillors for Alberta.

R. H. Knight.
R. H. Montgomery.

Councillors for British Columbia.

J. A. Calder.
N. C. Stewart.

The highest attendance at a meeting was 10.

The lowest attendance at a meeting was 4.

The average attendance was 7.

Mr. A. H. Hawkins was appointed to represent the Association at the meeting of the Ontario Land Surveyors in Toronto, February 17 and 18, 1920, and Mr. J. L. R. Parsons at the meeting of Saskatchewan Land Surveyors at Regina, March 1 and 2, 1920.

The Standing Committees called for by the By-laws were appointed at the Council Meeting on Feb. 13th. The Conveners are as follows:—

Geodetic Committee—Major D. H. Nelles.
Historical and Biographical Committee—G. H. Blanchet.
Publication and Publicity Committee—F. H. Kitto.
Town Planning Committee—H. L. Seymour.
Land Settlement Committee—T. A. McElhanney.
Land Surveys Committee—J. W. Pierce.

Topographical Surveys Committee—W. J. Boulton.

Other Special Committees were appointed from time to time as follows:—

A Committee for the Formation of a Canadian Institute of Land Surveyors—Convener, A. H. Hawkins.

A Committee to take up the matter of Classification with the Civil Service Commission—Convener, J. R. Akins.

A Constitution Committee—Convener, T. A. McElhanney.

A Nominating Committee—Convener, A. H. Hawkins.

A Program Committee—Convener, F. H. Kitto.

A Committee on Proposed Engineering Legislation—Convener, J. R. Akins.

The report of the Committee on Classification of Surveyors engaged in the Survey of Dominion Lands was received by Council at the meeting on March 18th and copies were sent to the Chairman of the Civil Service Commission and to the Surveyor General..

It was decided to issue the Annual Report on a larger sized page as being more economical. The tender of J. T. Pattison for an edition of 500 copies at $2.50 per page was accepted.

On March 25th the following motion was passed:—

> "That since under the last preceding constitution of this Association, membership was in effect forfeited on non-payment of fees, resolved that this Council is of the opinion that Dominion Land Surveyors who have been declared in arrears under the Constitution should now be considered eligible for membership and that the Association has no legal claim on them for back fees. Further, that the Secretary be instructed to inform such ex-members to this effect, the above to have effect after obtaining a majority of the votes of the present Council in favour of such action."

At the meeting on Nov. 4th the Secretary reported that the out-of-town members had been communicated with and that the majority of votes were in favour of the above motion. He was instructed to send out notices called for by the motion of March 25th and this notice was accordingly sent out to 41 members who had been struck off in 1919 for arrears of fees.

MEMBERSHIP.

On January 1st, 1920, the membership stood as follows:

Honorary Members	8
Active Members	207
Junior Members	0
Associates	0

During the year the following changes took place:—

New Members—Active	15
Junior	2
Associates	19
Resignations—Active	1
Deceased	1

On December 31st. 1920, the membership stood as follows:—

Honorary Members	8
Active Members	220
Junior Members	2
Associates	19

CORRESPONDENCE

302 letters were received and dealt with during the year.

REPORTS

Five hundred copies of the Annual Report for 1920—the 13th Report of the Association—were received and disposed of as follows:—

Members	216
Complimentary	16
Advertisers	13
Ontario Land Surveyors' Association	100
Miscellaneous	9
On hand	146
Total	500

FINANCIAL STATEMENT

January 1st, 1920, to December 31st, 1920.

Receipts

Balance from 1919	$251.35	
Fees Received	463.39	
Advertisements in Annual Report (1919, $12.00), (1920, $71.88)	83.88	
Sale of Annual Reports	5.75	
Government Grant	125.00	
Bank Interest	5.58	
Sale of Tickets for Luncheon, Feb. 1920.	67.50	
	1002.45	
Expenditure		$968.51
Balance		$33.94

Assets.

Bank Account of December 31st, 1920	$ 6.65	
Cash on hand	27.29	
		$33.94

Outstanding Accounts:—		
Advertisements in Annual Report	$ 30.00	
Total		$63.94

Liabilities.

Outstanding Accounts:—		
Rent of Collegiate Hall, Feb. 4th, 1920	$ 20.00	
Balance due on printing Annual Report	30.02	
Total		$50.02

Audited and found correct.

E. M. DENNIS.
S. D. FAWCETT.

January 28th, 1921.

THE CHAIRMAN: We have with us a delegate from the Ontario Land Surveyors' Association, and there may be one here from Quebec also. We welcome these delegates, and express our pleasure at having them with us. We grant them the freedom of the meeting and hope that they will enter into the discussion of all the subjects that are brought forward for consideration.

The meeting adjourned for luncheon.

LUNCHEON AT THE CHATEAU LAURIER.

The members of the Association and a number of distinguished guests met at luncheon at the Chateau Laurier at 12.45 p.m. The President, Mr. Seibert, presided. On his right hand was Sir James Lougheed, Minister of the Interior, and on his left hand Hon. Dr. Roche, formerly Minister of the Interior, now Chairman of the Civil Service Commission, and Mr. C. A. Magrath.

THE PRESIDENT: Gentlemen, it is fitting that our Association, composed as it is, of professional men whose duties are largely the exploring, surveying and developing of our natural resources, should have in the seat of honour on this occasion the Hon. Minister of the Interior. We are fortunate in having in that position to-day a man who knows Canada as few others do, and who has had in the past and still has a very real interest in the West. Sir James Loughead needs no introduction to Dominion Land Surveyors.

ADDRESS OF SIR JAMES LOUGHEED.

MR. PRESIDENT AND GENTLEMEN :

I have been making inquiry of myself as to why this goodly company of land surveyors should want to address them one who knows little or nothing about land surveying, and who is not familiar with the science or technique of their profession. Any observation which I may make I fancy will not be of very much benefit to a professional body like your own, yet, nevertheless, I appreciate the honour you have done me in asking me to be present on this occasion. I felt a sense of relief when I saw in the corridor of the hotel my good friend, Dr. Roche, who was my predecessor in the office which I attempt to fill at the present time, and with whom I was associated in Parliament for quite a number of years. It also gave me a feeling of pleasure to notice my good friend, Mr. Magrath, in the offing. I had the good fortune in the early days of the Northwest to be closely associated with him in a friendly way and to have that association renewed for some years past by our residence in Ottawa.

On an occasion like the present, one's mind naturally goes back in an attempt to recall what one knows about land surveyors and land surveying. It seems like sticking to the text to deal as closely as we can with the profession to which you belong. I think I am justified in saying that during a very considerable length of time, I have more or less breathed the atmosphere of your profession. I recall that in my juvenile days I occupied a very junior position with a firm in the city of Toronto, namely, that of Wadsworth and Unwin. The office being situated on Adelaide St., my preliminary training in the profession consisted very largely of testing the expansion or contraction of the chains on the sidewalk in front of the office of the firm. I remember we h adseveral spikes driven into the sidewalk, and while we took it for granted that there might be contraction or expansion in the chains, we always had the greatest confidence in the stability and fixity of our standards on Adelaide Street.

I can recall, with a good deal of interest, accompanying the Surveyors of those days on some of the survey projects which at that time were being carried out in the City of Toronto, and which projects afterwards developed into some of the subdivision activities of that city. Toronto, at that time, was beginning to taste the ambitions of real estate expansion and hence, was of considerable interest to the profession of Land Surveyors. It gives me pleasure to recall that there were on the staff of the office to which I have referred Surveyors who to.day occupy distinguished positions in your profession. In the Department of the Interior, with which I am associated, there are some with whom I had the pleasure of being associated at that time and this friendship I hope may long continue.

I fancy it was about that time that I first felt the lure of the great Northwest. The first Riel rebellion had directed the attention of Eastern Canada to the opening up of that enormous Territory, and the land surveying profession of that day began to look forward, with a considerable degree of anticipation, to taking possession of what seemed to be "the promised land" and to casting in their fortunes with the new El Dorado. Some years after that I found myself in the Northwest, and one of the happy memories, which I treasure highly, was the association which I enjoyed at that time, in those pre-railway days, with the many surveyors and surveying parties operating there, and who seemed to me to be laying the foundations of civilization in that Western Country. Many of them were the first white men who trod the vast prairies of that great wilderness. Many of them were the founders of the most successful settlements which we to-day have in these Western Provinces. I therefore look back with pleasure on the contact which I had with the members of your profession at that time, and with whom I came in contact more or less in Manitoba and the Northwest Territories.

As the years went by I in due time found myself more or less a fixture in Ottawa, where I came much in contact with my good friend, Dr. Deville, and more particularly in securing his good offices in adjusting the unsettled contract claims of many Land Surveyors, who had been engaged on surveying contracts for the Government in the Northwest Territories. We had a very exacting Auditor-General at that time, whom sympathy could not move, and it was very necessary that we should have the mathematical precision which Dr. Deville always brought to bear upon the settlement of those accounts.

More recently I found myself presiding over the destinies of the Department of the Interior. In fact, until your President, Mr. Seibert, directed my attention to it the other day, I was not aware that I had the good fortune to be the presiding officer, so to speak, over a department to which is attached almost one-half of the active members of your profession within the Dominion. So much for the knowledge which I indirectly have had of the surveying profession.

I am aware that since the Northwest has been to some extent settled up, there has been more or less discouragement on the part of members of your profession at the lack of employment which the situation is thought to involve. But I think there is no good ground for discouragement so far as your profession is concerned. In my judgment, we have only entered upon the threshold of Western development. It is a matter of very great satisfaction to those of us like Mr. Magrath, Dr. Roche and others who have spent the greater part of their lives in that Western country, that its development has reached such an advanced stage and that there is such promise of progress in the future. There is no prospect that gives me so much satisfaction as the knowledge that on this northern half of the North American continent we have land and climatic conditions as favourable for the development of a country great in virility, in population, in industrial resourcefulness, and in all the attributes of a great people, as they have in that half of the continent possessed by the Republic to the south of us. The United States has a population to-day of, I suppose, 120,000,000. It is interesting to note that a century ago the population of the United States was not much greater than the population of Canada to-day. When we remember the almost inconceivable difficulties which invested the development of that country, and when we think of the facilities we possess to-day by which our country can be populated, we have the greatest reason to hope that within a few generations we shall see within that Western country of ours a population of at least fifty millions of people.

May I direct your attention to the difficulties to which I refer, under which the Great Republic to the south of us was built up? A century ago, transportation facilities were not only restricted; they were almost unknown. Immigrants arrived on sailing ships; for at that time steam vessels were unknown. Publicity was unknown; the population of Europe was fifty per cent more or less than it is to-day. But notwithstanding these untold difficulties, the foundations of that country were laid and to-day the United States may be said to be one of the most progressive countries in all civilization. To-day. we have publicity methods that are unexcelled; that extend far beyond the most sanguine expectations of the men of those early days,—because to-day publicity reaches the four corners of the earth. When we think of the different systems of transportation that we have to-day and of the facilities which we have for placing the millions of Europe and the other continents upon the vacant lands of our Great Northwest, why should there be any hopelessness on the part of the people of Canada. Gentlemen, there should not be a moment when we do not look forward to a development at least as great as that which we see exemplified in the country to the south of us.

So I say, that we have not reached our growth in the West by any means. There is a great field for your profession to-day. Every day sees new areas being opened up and greater possibilities looming before us; and if there is any class of the community which to-day should be preachers of optimism, it is the Land Surveyors of this country. I know of no class of men who are quite in the same position as the Land Surveyors in many ways. Each has a sound mind in a healthy body. The period of time which he spends in the field, equal with that which he spends indoors, should make him a man of the soundest judgment in the community.

Now, I really had no intention of taking up so much of your time. So far as I can learn from perusing the literature which you have issued for a number of years, you can always rely upon Dr. Roche to give you an interesting address on the occasion of your Annual Luncheon. And from my personal knowledge of my good friend, Mr. Magrath, extending over a great many years, I know that he can fairly rival the Doctor in interesting you when he speaks.

Permit me to extend to you, Gentlemen of the Association of Dominion Land Surveyors, my congratulations upon the organization which you represent. It is a most desirable thing that Gentlemen belonging to a profession like yours, or to any other profession which is indispensable to the activities of our civilization, should get together; should have organization such as you have, and should attach value to that organized effort which is so beneficial to yourselves as well as to the community at large. I congratulate you also upon the successful Conference which you annually hold, and upon the appearance of the very representative gathering which I see before me. May I say in conclusion, that I wish you as an organization, and as individuals, every success.

THE PRESIDENT: We are deeply grateful to Sir James Lougheed for the honour he has done our Association in addressing us, for the kind expression of appreciation that he voiced, and, more than that, for the spirit of optimism characteristic of the true Westerner which he manifested and which will find a ready response in every Dominion Land Surveyor.

Dr. Roche needs no introduction to Dominion Land Surveyors. We have a very kindly spot in our hearts for him, and we always listen to him with a great deal of pleasure. Dr. Roche.

ADDRESS BY DR. ROCHE.

MR. PRESIDENT AND GENTLEMEN:

With the flight of time many changes are brought about—changes in Governments, in the personnel of Governments, and changes in Departments generally. Since 1911 there have been four different Ministers of the Interior. I do not know what the practice of your organization was prior to that time in regard to these functions—that is, whether you had been in the habit of having them for any considerable time prior to that date; nor am I aware as to the practice of my predecessors as Ministers of the Interior in regard to their attendance at such conventions. But during my tenure of office as Minister I always availed myself of the opportunity and privilege of being with you, and, in response to your kind invitations, have continued this practice to the present day. Last year, and the year before, I believe, my immediate successor as Minister of the Interior, the present Prime Minister, favoured you with his presence and gave you the benefit of his words of counsel, and his views on public questions generally, especially in reference to your own organization. I am pleased to note that on this occasion the present incumbent of the office, Sir James Loughead—another western man—is following a similar practice in this respect; for I am a firm believer in the personal touch. I believe that as close a personal relationship as possible should be established between the head and the body, the benefits accruing from such relationship being beyond measure. These benefits are along the line of increased efficiency, of closer co-operation generally, of a more intimate acquaintance on the part of the heads of departments with the personnel of your organization—all of which must tend to the mutual advantage of all.

But while Ministers may come and Ministers may go, your old war-horse and Nestor of the organization, the Surveyor-General—I will not say, goes on forever; for even he, when he has finished his race, will be called to his reward, but I am sure I voice the sentiments of all the gentlemen present to-day when I say that we wish Dr. Deville many years of continued usefulness in the discharge of the duties of an office which he has held for so many years with so much efficiency and with so much credit to himself and the ultimate advantage of his country. (Applause).

It has sometimes been said—and this is not at all indigenous to Canada; it is a phase of human nature generally—that it is necessary for a man to die in order that full justice may be accorded to him. I have often thought that if some of this superfluous adulation that is sometimes bestowed upon men after they have been removed from this terrestrial sphere, when it can do them no good, were but extended to them while they were still in the land of the living, how much more pleasant, how much more profitable, how much more satisfactory it would be—stimulating them, as it undoubtedly would, to a renewed zeal in the discharge of their duties and being a compensation to a certain extent for all the knocks received.

Now, Mr. President, I do not wish to take advantage of my presence here to talk shop. But there is one matter of vital consequence to a considerable proportion of your membership to which a reference on my part may be pardoned on this occasion; in fact, I have no doubt that you will welcome a pronouncement with regard to it. As you are aware, the position of Chief of Survey Party has in the past been looked upon as a seasonable position; that is, the employment did not last the year round. It is true that at the end of the field season the Chiefs of parties reported at headquarters, where they were engaged for a greater or lesser time in making out their reports of the season's operations and in other work incidental thereto. But there was always an interregnum of one, two, three or more months—if not always, at any rate, in most cases—between the completion of that work and the beginning of the next field season's operations, during which time they were not on the pay roll of the Government and were absolutely idle. Indeed, there was not even an assurance that the service of these Chiefs would be utilized during the succeeding year's operations, and while our good friend the Surveyor-General was only too pleased to recommend for re-employment all those whose work was of a satisfactory nature during the preceding year, and no doubt did so, patronage, as you know, was in vogue in years gone by, and no matter which Government was in power, pressure was always brought to bear upon the authorities to place political friends on the roll. As there was not room enough for all, some men, therefore, had to be displaced and replaced by others, some of whom were equally efficient, others being not quite so efficient. These circumstances created a great deal of uncertainty and doubt in the minds of the members of your profession regarding their future employment; indeed, there was more or less of a struggle every season to get upon the list. I will admit that this uncertainty has been intensified by reason of the soldier preference provision in the Civil Service Act. Now, I am sure we all agree that our returned soldier is entitled to every preference in connection with new appointments to the Service. These men left their civilian employment and, answering the call of duty, went overseas and acquitted themselves creditably in the trenches, and upon their return to civilian life, a grateful country cannot do too much for them. I am sure that your organization, which has taken a pride in the number of its men who were in the trenches, will be the first to admit this principle. But a number of your civilian surveyors were, through no fault of their own, unable to go overseas—some by reason of physical infirmity or defect which, while not interfering with the discharge of their civilian duties, would have militated against the proper discharge of military duties. To these men the question of their future is indeed a very vital one under present conditions.

Now, you know that prior to the beginning of last season these positions were advertised and thrown open to public competition, and under the provisions of the Civil Service Act, returned soldier applicants who possessed medium qualifications were placed at the head of the list and were assigned the first positions. The balance of the parties were made up of the more experienced, on merit, of your civilian surveyors. Owing, however, to representations that have been made to the Commission, not only by the Surveyor-General but also by a delegation of surveyors, a change is being made in this regard. This delegation of surveyors presented a memorial to the Commission pointing out that if the same procedure is to be followed in all subsequent years the result will be that the assistant of to-day under the minimum qualifications will be the Chief of to-morrow and that in a very few years every civilian surveyor will disappear from the service. There will be crowded out of the service men who have followed this work for a lifetime; men who, perhaps, are getting up to a time of life when it is almost impossible for them to obtain employment in other vocations; men whose training in the field has been such as to make them, to a certain extent, unfitted for other employment. To these men the question of the future and of the continued sustenance of their families is a most vital one.

I must admit that I was personally much impressed with these representations, and in consequence the Civil Service Commission has decided, taking into consideration the fact that these positions were thrown open to public competition last season and that a large proportion of those selected were returned soldiers, in justice to these returned soldiers, to the civilians to whom I have just referred, and to the country itself, whose desire it naturally is to retain in its service the most efficient members of your profession—the Commission has decided to recommend that such positions in the future shall be looked upon as permanent positions and that the incumbents thereof shall be confirmed as permanent employees of the Civil Service, enjoying all the rights and privileges pertaining thereto. If this recommendation of the Commission is accepted, as I have no doubt it will, this continuous struggle for employment at the beginning of every season will be at an end; this uncertainty will be removed, and, as I say, you will enjoy the privileges of the permanent Civil Service. When that is brought about it will be found advisable to change the method of compensation for the services rendered. The contract system, as you know, was in vogue for a number of years. When I was Minister of the Interior the Surveyor-General recommended that that system be changed because under it the country was really not getting the very best service, and it was deemed advisable to place such men on a per diem allowance—nine dollars a day, I believe—while in the field and while engaged at headquarters. But when these positions are declared to be permanent I think it will be found advisable to adopt a salary scale with a minimum and a maximum allowance and with annual increases as is the case with nine-tenths of the permanent Civil Service to-day. This rate of compensation will be worked out at a conference between officers of the Civil Service Commission and officers of the Department. Now, I think this will not be unwelcome news to those members of your profession who are specially interested, and I trust that the new arrangement will work out to the satisfaction of all concerned.

Mr. President, it seems but a comparatively short time since last we assembled around this festive board at your annual luncheon. I can scarcely realize that twelve months have elapsed; still, many and great changes have taken place during that time. Canada has been gradually assuming her normal position and normal condition after the dislocation which occurred in almost every line of business consequent upon the great world struggle for supremacy. The return to normal conditions is being brought about with a minimum of disturbance,—a striking testimony to the adaptability as well as to the sanity of our Canadian people, and an evidence of the sympathetic manner in which all just grievances have been considered and dealt with. Law and order has been the guiding principle in the settlement of vexed questions, the faithful observance of which has really been the secret of our success in this respect. Riot and revolution have been conspicuous by their absence; insidious and dangerous propaganda has no sooner been launched than frowned down by the very people to whom it was expected to make an appeal. Confidence in the ability of constituted authorities in the Dominion, Provincial and Municipal arenas to cope with trying situations that may arise from time to time has had a stabilizing and quieting effect upon our people. The strikes and scenes of violence and discord that have characterized the life of so many other countries have been almost an unknown quantity in Canada. This, gentlemen, is something in which we ought to take considerable national pride. It has been commented upon most eulogistically by the press and public men of other countries. If we but hold ourselves aloof from those disturbing elements that so frequently harass and destroy the peace and good government of other countries and exhibit that self confidence and moderation that are so essential to success, there is no reason why our efforts in the future should not be as bountifully blessed as they have been in the past. In this country of illimitable possibilities, affording homes to tens of thousands of our Canadian sons and daughters who have already located upon the soil; offering just as good inducements to the surplus population of other countries; opening up other avenues as well for the utilization of whatever talents a kind Providence may endow our people with, there is no reason why our young men should seek new homes under a foreign flag. It is true that far off fields may look green;

and in the case where an adventurous one has left his Canadian home to try his fortune in strange, and, perhaps, distant lands, led thither by tales of fortunes soon made or ambitions soon gratified, his home coming is as welcome to himself as it is to those whom he had left behind. Taught by that hard taskmaster, experience, his spirit subdued by trials and privations, well may he, upon returning to his native health, exclaim, in the beautiful words of the poet:

> "Breathes there the man with soul so dead
> Who never to himself hath said,
> This is my own, my native land."

Gentlemen, I know no country of greater promise; none more fruitful in its rich potentialities; none more calculated to inspire patriotic feeling on the part of its citizens, than our own fair country. I thank you. (Aplause).

THE PRESIDENT : The kindly remarks that Dr. Roche has made with regard to our honoured member, Dr. Deville, has met, I am sure, with a ready response in the hearts of all our members. His intimations with regard to the reclassification of Dominion Land Surveyors in the Topographical Surveys Branch are particularly welcome to those interested in that branch of the work, not only because they see that uncertainty of employment in the spring wiped away, but because the Branch will, under the new provision, be made more efficient. These men will be put in a position to give their utmost service to the Department and to the country at large.

We shall have to change the order of our programme a little; Mr. Magrath has an appointment, so I will call on him next. Mr. Magrath is a man of outstanding ability and an honour to our profession; and no words that I can say would enhance the good opinion that land surveyors as a whole entertain of him. We shall now hear from Mr. Magrath.

ADDRESS BY C. A. MAGRATH.

MR. PRESIDENT AND GENTLEMEN:

I have not the time to give you a speech this afternoon, even had I the capacity to do so, because in view of another appointment, I have already remained here longer than I should.

We have had two very interesting addresses; no two men are as intimately associated with the welfare of your profession as Sir James Lougheed, the Minister of the Interior, and Dr. Roche, the head of the Civil Service Commission. It was very pleasing to hear Dr. Roche tell us that he proposes removing you from patronage. Patronage, as a matter of fact, drove me out of the profession many years ago. I am not sorry, of course; but I remember the time when we had to appeal to the Minister of the Interior and keep hounding him, so to speak, in order to be allowed to go and work for our country.

But seriously speaking, it was the necessity of begging for an opportunity to work that drove me out of the profession. It is gratifying, therefore, to hear Dr. Roche say that a change is being made. He spoke about my old friend Dr. Deville and suggested that men should not be rewarded after they are gone, so to speak. Now, I hope that he, in conjunction with the Minister, will take that very much to heart, and realize that the time to reward men is to-day when they are actually working for their country. Sir James undertook to say that I had had something to do with his bringing up. Well, I am proud of my work, and if my influence amounts to anything with my old friend here he will take even a keener interest in the work of the land surveyors for Canada. I do not have to argue with anybody when I say that no group of men who are working for the people of Canada are unappreciated to the extent that the surveyors of this country are. They go out into the field; they work early and late; they have no time keeper in charge of them; so far as I know, they know no hours—certainly they knew none in my time; and in my days not one penny of public money was wasted in connection with the work of surveyors. There is a keenness on the part of the surveyors to drive forward and carry out the instructions given them by the Surveyor-General. The public servant who handles his work in that way should be properly rewarded.

Now, when it comes to the question of remuneration, let me direct the attention of my friend the Minister of the Interior, who happens to be a lawyer by profession, to this fact: In the city of Toronto, for instance, a surveyor will define the boundary of a piece of land upon which a million dollar building, perhaps, is to be erected. If that surveyor makes a mistake, there is a million dollars involved. The lawyer passes the title; if he makes a mistake, there is likewise a million dollars involved. And what does the surveyor get for his services and for the responsibility that he has assumed? If he gets $200 or $250, a great many people think he is paid too much; but no lawyer who thinks anything of himself will let the proprietor in a case of that kind get away with less than a fee of, perhaps, $2.000. I point to that as an indication of the fact that the public do not seem to appreciate to what extent the man who is a surveyor is deserving of remuneration. I have confidence in this gentleman to my left, whom I brought up—(laughter) and I do hope that both he and the head of the Civil Service Commission, both western men with western ideas—not the narrow-guage kind—will do the best they can for the surveying profession.

Dr. Roche has referred to the quickness with which time passes. It has been brought home to me very forcibly to-day that these events seem to come round very frequently; the older one gets the more quickly they seem to pass by. But one cannot help missing familiar faces., Since we were last here there has passed away a member of our profession, Tom Fawcett. Canada never produced a better man than Fawcett; and it is really regretable that there is often so little known of men of his capacity and his outstanding integrity; men who have always been ready to serve. I know I am stating what everyone in this room knows when I say that in Thomas Fawcett we had a great citizen who went about unostentatiously, doing his duty all the while. And it is only within the last day or two that grief has come to another member of our profession; I refer to Dr. Otta Klotz, who lost a son in this city within the past week; and I am sure that our sympathy goes out to him in this hour of his trial.

I thank you very much, gentlemen. If you bring your Minister here next year I shall say to him that I hope he has not forgotten his good wishes for the surveying profession. (Applause).

THE PRESIDENT: Gentlemen, I think Mr. Magrath's words need no comment from me; the facts that he stated are pretty well established. I will now call on Dr. Deville.

ADDRESS BY DR. DEVILLE.

MR. PRESIDENT AND GENTLEMEN:

I must, in the first place, express my appreciation of Dr. Roche's kindly references to myself. Dr. Roche is an old friend of mine, and perhaps he has put a little too much weight upon what I have done. In any case, I thank him for his kind remarks.

Mr. Magrath has just alluded to the sad affliction of Dr. Klotz, in which is found the reason for his absence from this gathering. He has been with us at every annual meeting, and we all miss him.

In the remarks which I propose to make, it is fitting that I should say something about the activities of the land surveyors. In the first place I might mention the Dominion Observatory. It is not exactly a surveyor's establishment, but the surveyors can take credit for it. It commenced in the early days with a small building on Cliff Street, and in time it developed to its present magnificent proportions; so we may include it, I believe, within the scope of the activities of Dominion Land Surveyors.

The work which they are doing is very important. In the first place, there is the practice of Seismology, a new science which will, in time, disclose to us many secrets pertaining to the interior of the earth. What it shows to us is the elasticity and density of the interior of the earth according to the rate of propagation of the earthquake vibrations. It is quite a new science; it has not progressed very far, but so far as it has progressed Dr. Klotz has taken a prominent part in it. He is recognized now as one of the foremost authorities on the subject. He has been made President of the American Association of Seismologists, and his work is very much appreciated by those who are working in the same line.

Another line of research at the Observatory is Gravity. Gravity also will disclose conditions pertaining to the interior of the earth. For instance, Dr. Klotz has found that the Rocky Mountains are, so to speak, floating upon the interior surface of the earth—not exerting pressure at any great depth. Gravity measures the attraction of the earth; the more dense the interior the greater is the attraction,—the greater the force of gravity; and when the gravity is small that shows that there is a lack of density in the interior of the earth at that particular place.

Another line of research at the Observatory is Magnetism, which is, of course, intimately connected with the sun. We do not yet know exactly the significance of magnetic influences, but it is being worked out. Other activities of the Observatory are the study of the sun and of its physical conditon, and studies of the radiovelocity of stars, all kinds of research work being carried on through the medium of the spectroscope. The Observatory has a splendid organization, and I think every Canadian has reason to be proud of its work.

Other branches of the surveying profession are engaged in the Geodetic Survey. The Geodetic Survey establishes reference points throughout the country for the purpose of controlling further surveys—that is to say, topographical surveys—in different parts of the country. They are also engaged in the establishment of precise levels, the object of which is to control secondary levels and other lines of levels in common use.

The engineers of the International Boundary Commission are engaged in marking and defining the boundaries between Canada and the United States, and every one who has examined the latest report of the Boundary Commission—that is, the report of the 141st Meridian—will realize that their work is equal to the very best.

Coming now to the Topographical Surveys, we find that an important feature of their work is the establishment of base lines and meridians as a control for the general surveying of the country. These lines are run in advance of the ordinary sub-division surveys, and they are located with very great precision, because they have to control the further surveys that come later. These lines now reach very far north; in fact we expect that next year they will reach the Mackenzie in the vicinity of Fort Providence.

Then, we have the sub-division surveys which lay out the townships for the settlers. Upon this it is not necessary to comment, except, perhaps, to mention the contrast between the work that is being done at present and the work that used to be done in old times under the contract system. Other work of the Topographical Surveys is the classification of land. Formerly, when there were large stretches of prairie land available, the need of classification was not so very much felt, but at present most of the vacant land is wooded. Under the old system, if a man wanted to take up a piece of land he had to find out for himself whether or not it was suitable for settlement. That was a very unsatisfactory condition of affairs, because the new settler is not competent to make an exploration of this kind; it should be done by properly qualified men, such as surveyors, and with properly equipped parties. This classification of lands forms a considerable proportion of the work of the land surveyor. Work of this kind was undertaken for the Soldier Settlement Board.

Another activity of the Topographical Surveys Branch is the re-surveying of lakes. In the early days there were a great many more lakes than there are at present, and in cases where lakes have wholly or partially dried up we have to make a re-survey in order to ascertain what the exact conditions are.

Then, we have the survey work in connection with the establishment and settlement of interprovincial boundaries. The survey of the boundary line between British Columbia and Alberta has been going on for some years, and a report in that connection will shortly be issued. Another kind of surveying. too, which is engaging the attention of the Topographical Surveys is the preparation of topographical maps. We have already published several of these maps, and I think they are very much appreciated; at least, that is the impression I gain from letters which I have received from different parts of the country. Men who saw active service at the front became conversant with topographical maps, having used them in connection with their military duties, and they now appreciate their usefulness. On their return they wanted to have the same kind of maps, and we are bound, of course, to furnish them. We have been making very good progress in that particular branch of the work.

There are, of course, quite a number of other branches of survey work which it is necessary to mention, such as the survey of mining claims, surveys of timber areas, and so on. Then, we have also the surveys of townsites. In old times the townsite was surveyed on the rectangular system, with the streets at right angles and running in any sort of way, but that time is past now; people want something better than that; and we have to devote a great deal more attention to these townsites than we did in earlier times..

I have been speaking only of the duties of surveyors in the field; I will not enter upon the work of the office, because that might lead us a little too far. But I think I have said enough to show the great expansion that there has been in the work that has been done and that is now going on under the direction of Dominion Land Surveyors. I thank you for your kind attention. (Applause).

The proceedings of the luncheon were concluded with the singing of God Save the King.

WEDNESDAY, FEBRUARY 2nd.—AFTERNOON SESSION.

The meeting resumed at 3.20 p.m., the President, Mr. Seibert, presiding.

THE CHAIRMAN : Gentlemen, we have for this afternoon a talk on Soil Characteristics, to be given by one who thoroughly understands his subject, Dr. Shutt. Without any further introduction, I will call upon Dr. Shutt.

SOILS AND THEIR CHARACTERISTICS.

BY DR. FRANK T. SHUTT

DOMINION CHEMIST

The task set me by your President this afternoon is an address on Soils and their Characteristics. He tells me that as your chief work has been, is, and will be, the measurement and locating of lands, so it will be increasingly important for you in the future as Dominion Land Surveyors to report upon the nature of the soils and the agricultural possibilities of the districts you survey. It is with the hope that I may be able to help you somewhat in this new phase of your work that I shall recount some of the more important fundamental or basic facts respecting soils, their nature and composition.

To adequately discuss all that is known about soils—chemical, physical and biological—would require several series of lectures. This address must necessarily therefore be incomplete and fragmentary; we must, however, endeavour to give you a skeleton or framework suitable for field use and which you by reading and practice can clothe and amplify into a fuller knowledge of soils and their properties.

Though we need not enter into any discussion of the several theories which have been advanced to account for the origin of the earth. it will be necessary, if we are to begin at the beginning, to say a word or two on that matter and more especially as it is related to the formation of soils—a phase of our subject which throws considerable light upon the nature of soils as we find them to-day.

We may for our purpose accept the theory that this earth ''was at one time a revolving mass of gaseous material''—a spiral nebula, of which there are many in the firmament to-day. Condensation took place and as a result we have a globe of molten rock revolving and travelling in its orbit through space. Cooling at the surface by radiation takes place and the dense clouds of aqueous vapor which surround it begin to condense and to pour down their contents in floods upon the heated earth. Again and again this water is vaporized until at last the crust is solid and the earth is cool enough for the waters to remain and seas and lakes and rivers have their beginnings. This crude outline may suffice, but it is of importance in indicating the first steps towards soil formation. It is in fact a continuation of those forces which at first held undisputed sway—weathering agencies we call them—that have and are to-day forming soils by the disintegration and decomposition of the rocks that formed the earth's crust.

Let us enumerate these weathering agencies.

Water—dissolving and wearing: Heat and cold—by expanding and contracting the rocks and thus, consequent upon the sudden changes of temperature, they are split and cracked finer and finer: the freezing of water in rock crevices resulting in further disintegration, since water expands in freezing; the immense grinding power of large masses of ice as in glacial action—a very potent agency in soil formation in the past and one still in force to-day: wind, by abrasion of rocks by the sand particles which, it may carry: gases of the air, especially carbon dioxide producing chemical changes. To this list might be added earthquakes, volcanoes and plants and animals. All these have been and are instrumental directly or indirectly in rock destruction which is the same thing as soil formation.

We may define a soil therefore as distintegrated, partially decomposed rock material. Generally or geologically speaking, the soil is that "total residue" resulting from these weathering agencies and lying above the solid rock; it forms a mantle to the earth, more or less friable and may be an inch or two in thickness or many hundreds of feet.

Agriculturally speaking the term soil has a restricted meaning and we find a differentiation into surface soil and subsoil. The surface soil consists of the disintegrated rock material mixed with more or less organic matter, the remains of plants and animals and the underlying subsoil consisting essentially of mineral matter. In farming parlance soil means surface soil, the portion ploughed. The nature and depth of the surface soil are two of the most important points to be observed in soil survey work; this will be emphasized later. The subsoil, of greater or less depth, is essentially composed of mineral matter, with little or no organic matter. The character of the subsoil, as well as the depth at which it commences should be noted, as the need for and the possibilities of effective drainage of the area are largely determined thereby.

With this broad outline we now enquire into the nature and composition of soils with a view of obtaining information that may serve as a basis for their classification.

Physical Characteristics of Soil the Basis of Soil Classification.

If we "feel" a soil by rubbing a little between the fingers, or examine it with a lens or stir a little in water and note the rate of subsidence, we shall conclude that soils are made up of different sized particles. According to size, these particles are known as gravel, coarse sand, fine sand, silt and clay. The nomenclature of soils is dependent on the proportion of these several constituents; soils therefore are classified on a physical rather than a chemical basis, though chemical composition as we shall see, is intimately related to physical characteristics or as we may say, to the size of the particles composing the soil.

Soil Components: Gravel—Coarse gravel would include small stones and small fragments of rock larger than 3 mm. in diameter. Fine gravel would similarly be particles between 3 and 1 mm. Soils composed wholly or essentially of gravel are of no agricultural value.

Sand—Coarse sand consists of particles between 1 and 2 mm. It is one of the most abundant of soil constituents. The grains for the most part are of silica which cannot be regarded as furnishing plant food, but associated with the quartz particles are fragments of rock which may in time, by further decay, supply small amounts of plant food..

Fine sand differs chiefly from coarse sand in size. Its particles lie between .2 and .02 mm. It usually contains a smaller proportion of true quartz or silica and a larger proportion of rock-forming minerals than does coarse sand.

The physical properties are all important in determining the nature—the tilth—and agricultural value of a soil.

Sand is porous, absorbent but not very retentive of moisture, possesses capillarity, is dense, is only slightly cohesve. These properties vary in degree according to the size of the sand particles.

Though sand is from the point of view of weight heavier than silt and clay, its presence makes soils, in the technical agricultural sense, lighter because it keeps them open and makes them easy to cultivate. Soil is a complex mixture and sand, though contributing but little in the way of plant food, is a valuable constituent, since its presence plays an important part, not merely in ease of cultivation but in the water and air content of soils and in presenting an easy foraging ground for rootlets—all important features in an arable soil, and conducive to productiveness.

Silt is intermediate in fineness between fine sand and clay; its particles lie between .02 mm. and .002 mm. When moistened it has a velvety rather than sticky feel. It consists in part of very fine quartz and in part of very fine particles of other minerals which in time may supply potash, phosphoric acid, etc., as plant food. A preponderance of fine silt makes a soil difficult to cultivate, for although not so plastic, tenacious, and impervious as clay, silt exhibits a considerable degree of cohesiveness, and the soils so characterized are apt to "run together" after rain and to cake badly on drying.

Clay particles are the finest of all soil components. In size they are less than .002 mm. in diameter. The finest clay particles may remain in suspension in water for many months and are scarcely discernible under the most powerful microscope .

Clay when wet is sticky, tenacious and slippery, and, after working in this condition dries and shrinks into hard, refractory masses. It is plastic, cohesive, "puddles" readily and becomes impervious, rendering drainage and aeration difficult or impossible. The presence of sand, carbonate of lime and organic matter all modify the properties of clay rendering it less tenacious and more easily worked.

Clay is essentially an hydrated aluminum silicate resulting from the chemical decay or decomposition of shale and a number of other rocks It is the most important constituent of soils from the standpoint of mineral plant food for it contains many compounds which possess potash, magnesia. lime, etc., etc. Its physical properties are, as we have noted, very pronounced, and comparatively small percentages will determine the nature of the soil.

Though clay is lighter, as regards density, than sand, soils in which it preponderates are known as heavy, since they are difficult to work.

There are many classifications of soils—European and American—but these we need not discuss in detail. The exact classification, which as we have seen is based on physical grounds, is a matter of great difficulty, or rather one of a great deal of tedious, exact work requiring a laboratory equipment. For practical, field purposes, however, we may use the following:

Gravelly Soils:—Consisting essentially of gravel or small water-worn fragments of rocks with more or less coarse sands. The amount of fine material will not usually exceed 25 per cent. and the humus (organic matter) content is never large. As a class they are among the poorest of soils.

Sandy Loam: contains from 50 to 80 per cent. sand, and are known as coarse or fine sandy loams according to the degree of fineness of the sand grains. The larger number of sandy loams contain from 65 to 75 per cent. of sand, largely fine quartz but not infrequently with fine material from the disintegration of crystalline rocks, e.g. granite. The amount of clay present is usually less than 10 per cent. Silt may be present to the extent of 20 per cent.

Loams are composed of 30 to 50 per cent sand (generally of varying degrees of fineness) and 50 to 70 per cent of silt and clay. In the general acceptation of the term a loam is approximately half sand and half silt and clay.

Silt Loams are those containing 50 per cent or more of silt.

Clay Loam would contain—

20 to 50 per cent sand.
20 to 50 per cent silt,
20 to 30 per cent clay.

Clay: a soil containing more than 30 per cent of clay.

There are necessarily many intermediate classes or types as, gravelly loam, silty clay loam, etc., etc.

In this classification it will be observed no mention is made of humus, the term used to denote semi-decayed organic matter, the remains of past generations of plants. Nevertheless it is one of the most important constituents of the surface soil, since its presence profoundly affects the productivity of the soil. It has various functions in the soil—chemical, physical and biological. It is the storehouse of reserve nitrogen, the most costly of the essential elements of plant food. By its further decay in the soil this nitrogen as well as the mineral plant food it contains, are set free in available forms for crop use. It is retentive of moisture, acting as a sponge—an important role since soil moisture is necessary to growth. It serves to "mellow" heavy loams, giving a desirable texture and good tilth. It furnishes the food for the countless micro-organisms of the soil which constantly prepare food for crops from the inert soil stores. The fertility of a soil (surface) is frequently determined by its humus content and that of its concomitant nitrogen.

Humus is a black waxy substance, coating the soil particles with a thin covering and thus imparting a dark color to the soil. As a rule we may say the nearer to black the more humus a soil contains. There are, however, certain red soils—the colour due to oxide of iron—in which the colour of the humus present is masked. In such soils of course the colour is no measure of the humus content.

Though not invariably—the exception being in semi-arid districts—the more humus a soil contains the richer it is in nitrogen.

From what has been said regarding humus and its properties, it follows that the differentiation by change of colour into surface soil and subsoil and the noting of the depth of the former are important features to be noted in soil survey work. In humid districts there is usually no difficulty in distinguishing the surface soil from the subsoil—the line of demarkation being fairly distinct. Of course, the deeper the surface soil the greater the agricultural value of the land, since it comprises the main zone from which crops obtain their food.

In semi-arid regions, as already remarked, there may be more or less difficulty in distinguishing between the surface soil and subsoil, the one gradually merging into the other without any distinct or sudden change of color or texture. Crop growth on these areas, when water is supplied, would indicate that the surface soil is in reality deeper than appearances would lead us to conclude.

A further word must be said as regards the subsoil, which as pointed out is essentially of mineral character. It will usually fall into one of the following classes or types: clay, sand, gravel and hardpan, the latter being recognized as a very hard stoney mass formed by the cementation of the soil particles. As already remarked, the character of the subsoil is an important feature as the need for and the possibilities of drainage are already determined thereby.

Lime is an important and valuable soil constituent; it performs many functions conducive to fertility. The absence of available lime leads to sourness or acidity—a quality or condition inimical to the growth of most farm crops.

Calcareous clays containing 10 to 20 per cent. of carbonate of lime merge into marls, essentially carbonate of lime, found as deposits at the bottoms of lakes and ponds and resulting from the disintegration of the shells of fresh water mollusca. When dry it has a chalky appearance.

Muck or Swamp Muck Soils.

These are essentially vegetable organic matter, well decomposed, compact and homogeneous and without much visible fibre. Some mucks contain notable quantities of clay and sand—5 to 30 per cent.—and these frequently make rich, fertile agricultural soils.

Peat is a deposit rather than a soil, consisting entirely of vegetable matter in a fibrous condition. It is very loose in structure and usually red-brown in color. As a soil it cannot be considered of any value.

Alkali Soils occur in semi-arid districts and are characterized by the presence of considerable amounts of certain soluble salts, chiefly sulphate, chloride and carbonate of sodium. These salts may appear on the surface of the soil as an efflorescence in seasons of scanty precipitation. White alkali (sulphates and chlorides) is less injurious to crops than black alkali, the essential constituent of which is carbonate of soda.

The **topography** or surface features should be observed and noted. The terms level, undulating, rolling, hilly, etc., are used in this connection, and the presence of rock, boulders and stones should be looked for and noted. The character of the vegetation and its growth—if scanty or luxurious—should also be noted, as indicating the relative fertility of a soil.

Elutriation Test may be used as follows: Stir a few ounces of soil (representative of the area) in a tumbler of water and note the rate and quantity of the precipitation of the particles. A fairly accurate estimate of the proportion of clay, silt, fine and coarse sand may be made. The coarse sand, if present, will be precipitated almost immediately, then the fine sand. then the silt, forming successive layers at the bottom of the tumbler, while the clay will settle much more slowly, the finer clay particles remaining in suspension almost indefinitely.

Acidity or Sourness. A simple test for acidity may be made as follows: Take up, by means of a spade or trowel, small quantities of surface soil from five or six places in the area to be examined. Mix all together and take from the representative sample thus obtained a few ounces of soil. Place in a clean cup or tumbler and pour thereon a little boiled water; stir the soil and water into a pasty mass and into this press a strip of blue litmus paper. If, at the end of fifteen minutes, the paper has turned red, the soil is acid. The rate and degree of reddening may to a certain extent indicate the degree of acidity.

Classification According to Texture.

1.	Medium Sand	80-100% sand (chiefly medium and coarse)
2.	Fine Sand	Composed mostly of fine sand.
3.	Medium sandy loam	50-80% sand.
4.	Fine sandy loam	50-80% fine sand.
5.	Loam	30-50% sand. 50-70% silt and clay.
6.	Silt loam	50% or more silt..
7.	Clay loam	20-50% sand. 20-50% silt. 20-30% clay.
8.	Clay	30% or more clay.

Loam—about half sand, remaining half silt and clay, silt predominating.

MR. BARBER: Mr. Chairman, I take great pleasure in moving a vote of thanks to Dr. Shutt for his very valuable paper on Soil Characteristics. He has given us a great deal of information which, I am sure, will be of great help, especially to our field men. (Applause).

MR. HAWKINS : I am sure that Dr. Shutt's address and the material that he has given us this afternoon will be of very great assistance in furthering our efforts to classify lands in the West. I have very great pleasure in seconding Mr. Barber's motion.

DR. SHUTT : I recognize the tremendous importance of this subject; and I recognize also how futile it is to attempt to give any more than a superficial outline in the time that has been at our disposal However, you all knew where I am, and if I can in any way assist you in your work, do not hesitate to call upon me. (Applause).

The meeting adjourned at 5 p.m. to meet Thursday morning at 10 o'clock.

THURSDAY, FEBRUARY 3rd—MORNING SESSION.

The meeting resumed at 10.15 a.m., the President, Mr. Seibert, presiding.

THE CHAIRMAN : The first item on our programme this morning is a paper on "Secondary Triangulation", by Mr. Rannie.

SECONDARY TRIANGULATION.

BY J. L. RANNIE, D.T.S.

Triangulation is the method employed for controlling the accuracy of surveys which have to be carried for long distances or over large areas, where the errors occasioned by using less accurate survey methods accumulate to a very appreciable amount, and where the geographic position of the parts surveyed is hence in considerable doubt.

Where these distances are very great and where the best accuracy is required, primary triangulation methods are employed, but to control the accuracy over a limited area or between primary triangulation nets or to project work for long distances where there is no primary triangulation control and where a combination of accuracy greater than can be obtained by the best land surveys, speed and low cost is desired, secondary triangulation has proved very useful.

Secondary triangulation methods have been used by nearly all Government Departments whose function is surveying and mapping. The most extensive example in Canada has been on the surveys of the International Boundary where the distance covered was approximately 3,000 miles. In this case the secondary trianguation was checked up at numerous points by the primary triangulation nets of the Geodetic Survey of Canada and the United States Coast and Geodetic Survey.

Accuracy.

The accuracy of secondary triangulation is in advance of even the best conducted land surveys, a fact which is beyond question; which fact, when the cost of secondary triangulation is taken into account, makes it a most valuable method of carrying geographic positions for long distances with good accuracy, and permits surveys to be started at widely separated points without danger of overlaps, gaps and offsets when these are finally joined, and which gives adequate control for topographic mapping.

A caution must just here be given as to the extent to which its accuracy keeps within wished-for limits. The United States Coast and Geodetic Survey stipulates that it will not usually be employed for carrying control for longer distances than 100 miles, which indicates that it should be checked up by primary triangulation every 200 miles. Of course, where it is not economical to project primary triangulation, secondary triangulation is the next best method to be used, and in any case is superior in point of accuracy to even the best land survey methods.

Speed.

With regard to speed, it is altogether a question of topography, vegetation and transportation. In a rolling country with few trees and with automobile transportation, a party of six or seven men should easily make 200 miles of progress in a season of five or six months, but in average country half this progress is easily possible. Very flat country and heavy timber delay progress—in fact they may make triangulation methods economically unadvisable.

Cost.

For a certain sized party the cost is proportional to the speed.

Any cost figures given below are to be taken only as an indication of the cost when applied to a particular type of country. They are the actual field costs and do not include any office expenses such as adjustments.

1. Area—New Brunswick—Main Boundary, 1915-1916.
   Cost—$60.00 per mile for 180 miles.
   Purpose—Location of boundary monuments four to six miles apart to control the accuracy of more detailed surveys.
   Type of Country—Half, or about 90 miles, was rolling country, heavily timbered with hard wood; at most stations lines of sight had to be cut through bush; transport by wagons, canoes and walking; other half, about 90 miles, rolling country, hills often wooded, timber valuable, lines of sight cut through bush or towers built, transport by automobile and wagons.
   Size of Party—9 men.
   Time required—2 seasons of 5 months each.
2. **Area**—Quebec—Vermont Boundary, 1917.
   Cost—$55.00 per mile for 90 miles.
   Purpose—Location of boundary monuments at five or six mile intervals.
   Type of Country—Rolling country, timbered in parts, transport by automobile.
   Size of Party—8 to 12 men.

Time required—3 months.

3. **Area**—141st Meridian, between Alaska and Yukon.

Cost—$340.00 per mile for over 700 miles; transport charges and time spent travelling to and from scene of operations accounted for 70% to 80% of the above amount.

Type of Country—Rolling to mountainous, with little timber; transport, canoe and walking.

Size of Party.

The size of party required varies from 7 to 12 men, according to the nature of the country. In general a party is made up as follows:

Reconnaissance—Engineer and Assistant.
Station Preparation—Two to five men.
Angle Measurement—Engineer with perhaps a recorder.
Transport, etc.—As required.

The same party would be sufficiently large to measure any base-lines which might be required.

Structural Strength of Figures.

Geometrical considerations enter into the problem of secondary triangulation quite apart from the accuracy with which the instrumental work is performed. The first axiom is that those figures must be employed which will permit a check on the calculated length of any line in the triangulation. Thus, quadrilaterals and 3-, 4-, or more—sided figures with an interior point visible from the exterior points, permits of such a check. Central point figures in general cover greater area, but the quadrilateral with diagonals open is considered the most accurate form of figure of any triangulatioon scheme. The second point which comes under the head of structural strength is the shape of the individual triangles composing the figures. Obviously, errors in the angles of poorly shaped triangles will produce larger errors in the lengths of the triangle sides than in the case of well shaped triangles and hence the geometrical shape of the individual triangles must be a governing principle in deciding where base-lines are located which will check up the errors of scale produced by angular errors. So far as the writer is aware, the criterion of the United States Coast and Geodetic Survey is the best at present available for judging the requisite structural strength.

Base Lines.

As stated above, base.lines are introduced in the general locality indicated by the limiting weakness of the geometrical conditions. The methods and apparatus used should be such as to ensure a limiting constant error of 1 part in 75,000 and the accidental errors should not be greater than 1 in 200,000. Two measures of this base with invar tapes properly standardized, or with steel tapes properly standardized, if the measuring takes place on cloudy days or at night, will give the necessary accuracy.

Length of Lines.

The length of lines depends on weather and topographical considerations, the clearer air of the West permitting of longer lines than that in Eastern Canada. Sights of about 2½ miles are practically as accurate as longer sights, in-so-far as errors due to eccentricity of signal or instrument are concerned. The economic length of line is one which will make the cost of all operations a minimum. Short lines mean more base-lines, greater cost of reconnaissance, measurement of angles, etc.; long lines may mean more lost time for reconnaissance and measurement of angles and the introduction of supplementary stations to meet the requirements.

Horizontal Angle Measurement—Accuracy.

All operations must be designed to give the required accuracy—and no more. Hence the selection of instruments, methods of angular measurement, type of signals, selection of observing conditions, etc., are to be such that the average closure of triangles will not be greater than 2 to 3 seconds and the maximum error seldom greater than 8 seconds.

These limits, with the strength of figures, frequency and accuracy of base-lines, should insure a discrepancy between base lines of less than 1 in 10,000 and probable errors of 1/3 or ¼ of the above, i.e., 1 in 30,000 or 1 in 40,000.

Horizontal Angle Measurement—Instruments and Methods.

Either a direction or a repeating instrument may be employed. A 6 or 8-inch direction instrument provided with micrometers, with direct and reverse readings taken in 5 positions of the horizontal circle, or a 6-inch repeating instrument reading by verniers to 10 seconds, using 6 repetitions direct and 6 reverse will generally give the required accuracy, though these figures may have to be increased at times when sighting conditions are poor.

Signals.

The type of signal which is in many respects the most convenient is a tripod, in the top of which is fixed a vertical pole. The bottom of the vertical pole ends about 6 feet from the ground to permit the theodolite to be set up over the station without disturbing the signal. There are several ways of constructing this signal, of which illustrations appear in many text books. The pole may be covered with white and black bands of cotton, or diamond shaped pieces of cotton on frames may be nailed on the pole. The color of these cotton diamonds depends on the background, while the size depends on the clearness of the atmosphere. In the Maritime Provinces, a signal two yards square will not show up any better on a 6 or 8-mile line than a 1-yard square signal can be seen in the West.

Elevations by Zenith Distances.

It is not generally realized that fairly good elevations may be carried by trigonometric levelling in connection with secondary triangulation. The following example shows a balancing of errors when proceeding long distances:

Distance from Starting Point.	Error in Elevation.
50 miles	+ 2.3 feet
65 "	+ 1.1 "
90 "	+ 5.7 "
125 "	— 1.1 "
170 "	— 5.5 "

In the above case, elevations were read to 20 seconds and measurements taken at any time of the day, although it was attempted to obtain them as near noon as the disposition of the work would permit.

Astronomic Work.

The only reliable and unchangeable datum for the geographic position of a system of secondary triangulation in Canada is that furnished by the primary triangulation, namely, the North American Datum. Astronomically observed latitudes and longitudes are subject to errors due to the deviation of the plumb line which may make them quite unreliable for checking the accuracy of surveys made with any degree of precision. Their field is restricted to affording new points of departure for geographical surveys in unsurveyed regions, in which cases the geographic position should be checked as soon as possible by triangulation connection with points based on the North American Datum.

Where secondary triangulation has been connected to primary triangulation, Laplace points (combined triangulation, longitude and azimuth stations) are introduced every hundred miles or so to correct the twist. Even in such cases only the **relation** between the observed longitude and azimuth, is used, since the errors of observed longitude and azimuth, due to the deviation of the plumb lone, balance when placed in the Laplace equation. The final position of and final azimuths at these Laplace stations may vary con-considerably from the astronomically observed quantities.

Where secondary triangulation has been started from an astronomical station at whch the azimuth has been observed, the only way to control twist is by further azimuth observations every 30 to 40 figures. Even in such cases caution must be exercised, since in hilly country observed azimuths may easily be in error by 10 to 20 seconds due to deviation of the plumb line, which is more than the azimuth of the triangulation may be expected to be in error in a couple of hundred miles.

Marking of Stations.

Triangulation stations should be marked in a permanent manner, else the usefulness of the whole survey is very restricted. While the immediate purpose of the survey may be the production of a map, it is a pity for the triangulation data which is secured at a great expense to be made of no **future** value simply because the stations are not permanently marked.

Triangulation is coming into its own as a popular method of control, not only for the topographic mapping, which is due for great expansion in Canada, and for hydrographic work, but for surveys of all large properties where intensive development is taking place, for large engineering works of all kinds and for compiling maps where land surveys furnish the only present control. Thus, it is of the utmost importance that the ground markings of triangulation operations be preserved for the future.

Connection with Primary Triangulation.

That the best use may be made of levelling results it is highly desirable that the datum of all levelling operations be the same—mean sea level. It is equally desirable that all triangulation results be placed on the one datum to avoid offsets, overlaps or gaps where surveys join. This is only possible by having all geographic positions referred to the North American Datum which is the datum for the geodetic results of Canada, United States and Mexico. This means that surveys should, wherever possible, be connected to the primary triangulation nets of the Geodetic Survey of Canada, which have a relation to other surveys analagous to that of a supreme court to lesser courts, so far as the geographic positions of points are concerned.

Unfortunately, the primary triangulation was started in Canada 25 years late, so that it is not available wherever it is required. However, if secondary triangulation schemes are permanently marked on the ground, they can later be connected to primary triangulation as it progresses and finally all triangulation results can be moulded into one harmonious whole on a co-ordinated scheme and on a basis which gives the proper relation of one part to another.

In conclusion, it seems worth while to claim that co-ordination of geographic results in Canada can best be obtained by the extension of any large schemes of secondary triangulation by the Geodetic Survey on request from other departments. In this way those on whom responsibility rests to connect all schemes of secondary or tertiary triangulation by means of the primary will be familiar with the details of such work and with the methods employed, thus results will be available from one central bureau instead of from many, and thus also should economy be effected in performing this important work.

After some discussion the Chairman read Mr. R. H. Montgomery's paper on "Levelling."

SYNOPSIS OF PAPER ON LEVELLING.

BY R. H. MONTGOMERY, D.T.S.

Commencing in a modest experimental manner in 1905, levels are now taken on all original surveys. At first each line of levels was commenced from an assumed datum, but it was soon found necessary to run precise and secondary control lines to connect up the isolated levels, thus obtaining level nets for control and reducing all levels to the same datum. Up to date the milage of levels run by this Branch is as follows:

4,220 miles of Precise levels,
3,000 " " Secondary levels,
23,400 " " Tertiary levels.

Precise Levels.

For this work a party consists of observer, recorder, umbrella man, two rodmen, bench mark man, and a railway motor car driver. The work is carried out along railway lines. Permanent bench marks not more than four miles apart are established, being brass bolts set into permanent structures, such as public buildings, bridges, etc., or concrete piers erected for the purpose.

The instrument used is the binocular level of the United States Coast and Geodetic Survey pattern with a rod in one section 10½ feet long with a ball pointed shoe.

The procedure follows the general practice of all large precise levelling surveys. Sections of the line approximately one mile in length are levelled in opposite directions and the two measures must agree within the limit of 0.015 ft. in a mile section, the mean of the two being taken as the true measure. Three circuits, each with a perimeter of about 1000 miles, have been closed with field closures of +0.091 ft., —0.172 ft. and —0.027 ft., indicating a high standard of precision. A comparison of the results of the Goedetic Survey and our survey in the measure of the levels between Winnipeg and Edmonton over two different routes shows that starting from the same bench mark at Winnipeg, they disagree at Edmonton by only 0.018 ft.

Secondary Levels.

The party consists of an observer, umbrella man, two rodmen and a motor car driver. Permanent bench mark iron posts are planted at intervals of about three miles. The lines levelled are usually along levelled roads. The instrument used is the Zeiss level.

The procedure is the same as for precise levels, the limit of error on the mile sections being 0.035 ft. on account of the rougher nature of the line.

Tertiary Levels.

These are levels carried on in conjunction with original surveys, and comprise two classes: a double line along base or principal meridian lines, and a single line in subdivisions where closed circuits are made. The limit of error allowable in either case is one-tenth of a foot per mile.

The instrument used is the dumpy level and the bench marks used are in general the tops of the standard survey posts. The accuracy attained on this work is very satisfactory.

Examination of the Precision of a Line of Levels.

The internal evidence may be deduced from the local discrepancies between the two measures over each section. The external evidence is from circuit closures. The observer's object is to obtain a true value for each section and to attain this end he must ascertain the two measures under as different conditions as possible compatible with speed and economy.

Bench Marks.

The future value of levelling operations depends upon the permanency of the bench marks. The causes of the destruction of bench marks are:

(a) Mechanical; caused by man, animals or by growth of vegetation.
(b) Chemical; such as weathering and decay.
(c) Physiographical changes; movement of rivers, drifting masses, and encroachments of the sea.

By far the most destructive agency is man. According to the standards of the Indian and the British Ordnance surveys, practically all our bench marks rank as secondary or short lived.

The Correction for Gravity.

The force of gravity varies at different points on the earth's surface both in direction and intensity and this variation necessitates the introduction of a correction in levelling operations of a high degree of precision. The force of gravity may be expressed as a function of the latitude and the altitude of the point on the surface of the earth. It is probable that the datum of Canadian levels will be the same as that of the United States survey which is an arbitrary plane on which all points have the force of gravity equal to that of sea level at latitude 45°. All absolute elevations, referred to a datum plane, may be expressed as dynamic heights or as orthometric elevations. either of which may be deduced theoretically, the other being given. The process of levelling is a combination of the two methods, the measure of the different heights of instrument on the rod is an orthometric operation, while the carrying of the level line from one rod to another is a dynamic process. As an illustration, in the survey of the fourth meridian from the International Boundary to Lake Athabaska, a distance of 690 miles with a fall of 2105 feet the dynamic difference is 2104.8 feet, while the orthometric difference is 2106.8 feet.

Adjustments of Level Nets.

No adjustment of Canadian precise levels has yet been made. In the United States adjustments were made in 1899, 1903, 1907 and 1912. As many elevations are based on assigned elevations of permanent bench marks, it is desirable that no change be made in a published elevation. For this reason, it was decided not to change elevaions which agreed with the latest adjustment. As a result of this procedure, a considerable number of the old elevations were retained.

Our Canadian net is controlled by sea level points on the Atlantic, Pacific and Hudson Bay. We can also take advantage of the existing United States net at many points. Consequently our net should prove to be very substantial.

Once the precise level net is adjusted, the secondary adjustment can be carried out and from that the tertiary levels.

MR. CUMMING: I move that the Secretary be instructed to write a letter of thanks to Mr. Montgomery for his paper, telling him how much we appreciate it and expressing regret at his inability to attend the meeting. (Applause).

The motion was seconded by Mr. Rannie and carried unanimously.

THE CHAIRMAN : The paper on "Town Planning", by Mr. W. A. Begg, D.L.S., will be read by Mr. Hawkins.

TOWN PLANNING IN SASKATCHEWAN.

BY W. A. BEGG, TOWNPLANNING ENGINEER.

A Resume of Developments Since the Passing of the Town Planning and Rural Development Act, 1917, and of the Methods of Regulating Land Subdivision Employed Since 1909.

The administration of the Town Planning and Rural Development Act naturally became the duty of the Department of Municipal Affairs, which had been organized since November 1, 1908.

In the departmental report of 1917-18 after the passing of the new Act, Mr. J. N. Bayne, then Deputy Minister, commented as follows:

"In the minds of too many, town planning generally is not regarded as important. The impression that the principles of sane arrangement of the layout of townsites in villages, towns and cities, and even of farms and farm land in the rural areas, are not vital, is erroneous. The subject is wide and in some centres throughout Canada and the United States includes in a most practical way the housing of thousands of workers at munition plants and other industrial centres . . . .

"A Director of Town Planning will be associated with the Department of Municipal Affairs. By-laws and regulations for municipal institutions will be suggested for the purpose of enabling these self-governing bodies to ensure that townsites will be laid out on modern healthful lines rather than for the purpose of speedy sale and high profits for the vendors."

As Mr. Bayne was shortly thereafter made a member of the Local Government Board it became the duty of his successor and present Deputy Minister, Mr. J. J. Smith, to complete the organization of the new Branch. Mr. M. B. Weekes, Director of Surveys, was appointed Director of Town Planning, and the writer became on the 1st of May, 1919, Engineer to the Branch.

The first work undertaken by the Branch after its organization was the preparation of the various regulations necessary to bring the Act into operation. These are as follows:

"Town Planning and Rural Development Procedure Regulations, relating to Schemes and By-laws."

"Regulations respecting New Streets and Subdivisions."

"Model Regulations respecting New Development for adoption by Urban Municipalities."

In the preparation of the above, valuable assistance was given by Mr. Thomas Adams, Town Planning Adviser, Commission of Conservation, Ottawa. When completed, the draft regulations were revised in the office of the legislative council and received approval on May 19th.

The Regulations respecting New Streets and Subdivisions were issued as soon as printed with an intimation that all subdvision of lands made after June 1, 1919, must be submitted for approval in accordance therewith. To provide for the approval of subdivisions of which the survey had been made prior to June 1, 1919, an arrangement was made by which such subdivision would be approved by the Director of Surveys under the former regulations of the Department of Highways provided the plans were submitted for approval prior to January 1, 1920. The first application for approval of a development plan was received on August 21.

The number of applications received and dealt with since that date until January 1st, 1921, is given in the following classified summary.

Class of Development Plans.	No. of Plans.
New Townsites	37
Additions to hamlets	25
Additions to villages	72
Additions to towns	10
Additions to cities	2
Summer resorts	2
Total	148

As the list shows the development so far undertaken under the new Act is to provide for a legitimate demand for building sites in the smaller but growing communities and at shipping points established on the new railway lines. No new developments have taken place in connection with the establishment of industries such as have occurred in Ontario and elsewhere.

Building in the new townsites and hamlets is undertaken by individuals erecting their own places of business and homes and as at the start there is no resident representative of the townsite company and seldom within convenient distance any representative of the rural council, the control of building development in the case of a new townsite is not at present undertaken. These points should be kept in mind by those not well acquainted with western conditions when examining the development plans submitted as examples.

When a townsite or hamlet has a resident population of fifty or over it may become incorporated as a village. When this has been accomplished and a council elected the village is in a position to adopt building bylaws or development bylaws and enforce the same. Two villages and one rural municipality have adopted regulations respecting new streets and subdivisions.

Early in January of this year a model form of development bylaw adapted for communities of 5000 population or over was printed and issued to the city authorities and a simplified form of the bylaw has been prepared for distribution to the towns and villages.

The enforcement of the provisions of a town planning bylaw or scheme is dependent to some extent upon the existence of a building bylaw establishing a control over the erection of buildings by the requirement of a permit. As such a control has not been commonly adopted in the villages and towns, a draft building bylaw was prepared by the Branch which has been enacted in a number of places under the Municipal Act.

Developments Within the Cities.

The City Planning Commission of Swift Current was organized prior to the passing of the Act respecting Town Planning, and has published a number of reports and a draft scheme. The reports go to show that the commission has been active in the interests of the city and has submitted to the council and secured the passing of bylaws respecting plans for boulevarding streets, building lines and tree planting. In July, 1920, the commission was re-constituted under the provisions of the Town Planning and Rural Development Act and was authorized among other matters to prepare a development scheme. The bylaws governing the appointment and duties of the Commission and other matters relating to city development have been published in a convenient form for distribution.

The council of the City of Saskatoon which as early as March, 1914, passed a resolution recommending the passing of town planning legislation in Saskachewan has made the first application to the Minister of Municipal Affairs for authority to prepare a scheme. Commissioner C. J. Yorath has been appointed as development engineer under the Act and the proposals indicate that the scheme would be prepared under his direction.

Land within the incorporated limits of the cities has been subdivided to such an extent beyond the demand for building sites that very little new development can be undertaken unless in the nature of replanning. One of the chief obstacles to the preparation of a development scheme is the existence of large areas covered by unnecessary registered subdivisions. An estimate has recently been made of the area in and adjacent to the seven cities of the province which still remains subdivided into small building lots for which there is absolutely no demand. The estimate shows that approximately 12,560 acres within the limits of the cities and 26,460 acres adjacent thereto are still affected by useless subdivisions.

The total area of approximately 39,000 acres does not include the area of any subdivision on any part of whch buildings have been erected or the area of any allotments for market garden purposes, whether so used or not. Since the end of the boom in 1913 and with the aid of the Subdivisions Act of 1914, subdivision plans affecting an area of approximately 8,160 acres have been cancelled in the same areas but the figures show to what extent cancellation is still necessary.

Housing Developments.

No municipality in Saskatchewan has as yet undertaken a housing scheme or applied for a loan under the Act respecting housing in urban municipalities.

In Regina two housing projects have been undertaken by companies the houses being rented to their employees. Twenty-one dwellings were erected each on a lot 33½ feet in width by 125 feet in depth. A lane 20 feet in width provides access to the rear of each lot, and the houses conform to the building line established by the city, the main front wall being at a distance of 25 feet from the street line. The streets surrounding this block had been established for some time. One street is 100 feet in width and the others 66 feet in width.

The City of Regina in 1912 erected a number of houses to provide accommodation for those who lost homes in the cyclone.

The difficulty experienced by the city in disposing of the houses up until the recent shortage became pronounced, has frequently been used as an argument against such municipal ventures. The monotony of the arrangement has been recognized as a detriment to the disposal of the houses. The space between the houses is approximately 10 feet and the depth of the lots 125 feet.

The Imperial Oil Company has also a housing development for its employees. No figures have been made public as to the cost of the houses in these schemes.

Sunlight Planning.

Apart from its consideration in connection with the orientation of the buildings of the larger institutions of the province such as the Mental Hospitals of North Battleford and Weyburn, and the Sanatorium at Fort Qu'Appelle, sunlight planning has not consciously been a factor in any known development. At one time it was advocated in certain quarters that the streets of all new townsites should be laid out parallel to the section boundaries, irrespective of the bearing of the railway in that section. Fortunately this is not the general rule. The writer was and is still opposed to such a proposition aside from topographical and other reasons, on the ground that streets at right angles to the railway with cross streets parallel thereto, in general gave a longer period of sunlight to all sides of the greatest number of buildings. This view will be explained by a reference to the prevailing direction of the railway lines in the Province.

If an examination is made of the general direction of the majority of the lines, it will be noticed that a very considerable mileage has a bearing between 40° to 70° west of north, and it follows that a large number of towns and villages have the main residential streets bearing between 50° and 20° east of north. The dwellings in the smaller communities are detached and each is usually situated on a lot of 50 or more feet in width. Thus by a happy set of circumstances an orientation has been made possible which, in the writer's opinion, is most favourable for that class of development.

In the cities of the Province the tendency to crowd dwellings is more noticeable and, with one exception, each city has a majority of residential streets bearing north and south. The orientation generally adopted provides for the longest possible period of sunlight to reach the interior by the unshadowed east and west windows. In the central area of a city where the greatest height and density of buildings may be expected the east or west frontage is desirable but in the outer portions where a limitation might be placed on the number of dwellings to the acre a variation in angle of bearing of the residential streets ought to be introduced if the layout is not otherwise established by a consideration of the topography and the probable main lines of traffic.

As an example of a small housing development in which sunlight planning had a place an illustration is shown of an arrangement of cottages at the Provincial Mental Hospital, North Battleford, planned by the Department of Public Works in co-operation with the Town Planning and Rural Development Branch.

Land Surveyors and New Development.

Land Surveyors are brought into intimate connection with work under the Town Planning and Rural Development Act through the regulations respecting the subdivision of land which require that the development plans of a subdivision shall be signed by a Saskatchewan Land Surveyor. On that account it may be of interest to relate something of the origin and growth of the regulations and the present procedure in connection with submission of a development plan for approval, using a few typical occurrences as illustrations.

Regulation of Land Subdivision Prior to 1918.

The subdivision of land into lots and blocks for the purpose of sale and transfer by means of a plan had since 1908, been under a certain degree of control secured through the Land Titles Offices. In 1909 before any plan of subdivision could be registered the plan had to show endorsed thereon the approval of the Commissioner of Public Works or the approval of the council of the city, town or village which had filed satisfactory regulations with the Commissioner.

By 1911 the Department of Public Works had secured authority to regulate the subdivision of land under the Public Works Act and new regulations were drawn up instituting the requirement of a preliminary topographical plan showing contours, and approval fee and the practice of inspection. The writer became associated with the work at this time as townsite inspector.

In 1911 and 1912 the number of plans submitted increased very rapidly and the area commonly covered by a single plan was 160 acres and in many instances 320 acres. In 12 months at this time the total number of plans dealt with was 471, of which 117 were new townsites. A large amount of the subdivision undertaken was to provide necessary building sites, and the closest attention was given to this class of development and to new townsites. Land unsuitable for building purposes was refused approval but very little attention could be given to the form of layout except to provide for the continuity of streets along the boundaries of adjacent subdivisions.

The regulations were again revised in 1913 and by this time the public seemed prepared for some restrictions to prevent unnecessary subdivisions. Accordingly at this time the requirement of a public reserve in addition to the streets and lanes on the basis of 5% of the area to be registered was inserted and the minimum width of a lot in a residential area was fixed at 40 feet and the minimum depth at 120 feet. At the same time the approval fee was changed from an acreage basis to a fee per lot. These provisions had an immediate effect as they greatly reduced the number of lots to be obtained from an acre and a large number of unnecessary projects were abandoned.

The requirements of public reserves in connection with the subdivision of land has met with favour in the newer communities and has been firmly established by its incorporation in the Town Planning and Rural Development Act as a compulsory provision. Upon registration of a plan the public reserves became the property of the Crown in the right of the Province and in the same manner as do the streets and lanes and the policy adopted in regard to their disposal has been to lease the reserves for school purposes and as sites for publicly owned buildings on long terms and on condition that the property is used for public purposes and kept in good condition.

Regulation of New Development Under the Town Planning Act.

The intention of the Act respecting town planning is that each local authority shall undertake to control the laying out of new streets and subdivisions under regulations submitted to and approved by the Minister. It was considered advisable to provide that the supervision which had been exercised by the Department of Public Works and latterly by the Department of Highways should be continued by the Town Planning Branch until the local authorities had had time to consider and adopt regulations.

New regulations were accordingly considered and issued as previously stated. Latterly some minor amendments have been made. In order to explain the regulations, the application made with respect to the townsite of Kelvington will be briefly described.

This townsite is situated on a branch line of the Canadian National Railways and the townsite is owned by Canadian Northern Realties, Limited. The plans were prepared by the C.N.R. engineering department at Winnipeg.

The small blue print marked "1st position" was submitted prior to a survey being made, the information as to the site having been obtained by the resident engineer. The submission of such preliminary sketches for discussion is welcomed by the Branch, although no formal approval can be given thereto.

When the topographical survey had been completed by a Saskatchewan Land Surveyor and the "development plan" had been prepared, a notice in accordance with a prescribed form and a copy of the plan was forwarded to the secretary-treasurer of the rural municipality. The notice stated that the plan would be submitted to the Director of Town Planning at the end of one month from the date of the notice. Any objections to the plan had to be submitted to the townsite company within that time.

Usually prior to the end of the specified month the application reaches the Branch. The application, to be complete, must include (1) the plan of development on tracing linen and one blue print copy, (2) a copy of the notice served on the local authority and a copy of any objections made by the local authority which have not been removed, (3) a report dealing with the information required under section 4 of the Regulations. (Copies of these documents are attached to the plan illustrating the application.)

Upon receipt of the first notice of the location of a new townsite the proposal is examined in relation to the approved main highways in that locality. If for any reason the location appears unsatisfactory and likely to be inaccessible, except at great expense, from any improved main highway, the matter of the site of the **proposed siding** is referred to the rural council. In case the council finds reason for objection an appeal can be made to the Board of Railway Commissioners respecting the location of the siding as this matter is within the jurisdiction of that body.

Assuming that the location is not objectionable the proposed streets or roads connecting the townsite with two of the road allowances bounding the section are given consideration. As shown on the plan a profile of the connecting road is given showing the steepest grade to be under 4%. In this instance a crossing over the railway is proposed and in such instances the approval of the Board of Railway Commissioners must be secured by the townsite company before the plan is registered. This stipulation usually assures that the cost of construction and maintenance of the crossing will be borne by the railway or townsite company.

The plans of the connecting roads may be prepared, and submitted to the Department of Highways for registration in the usual manner providing compensation for the land taken is guaranteed by the townsite owners.

The location of the public reserve must be satisfactory and on dry ground. Sites adjacent to the railway are not approved unless the plan of the townsite is small and the elevation of the ground and other circumstances are in favour of such a location. The first reserve in new townsites is most frequently required for school purposes. The illustration shown of the town of Shaunavon, which was approved in 1913, shows the public reserves secured and the disposition which has been made thereof. The development plan of the townsite of Naicam and of a part of the village of Arran also illustrate arrangements of public reserves.

The townsite companies connected with the Canadian National Railway and the Department of Natural Resources of the Canadian Pacific Railway Company are together responsible for 70 per cent. of the development plans submitted under the new Act. The tendency of the companies is to adhere to standard block sizes and street widths in all locations and to the production of a street system once established to the limit of their property. The simplicity of the rectangular street system makes for economy in surveying and it is not improbable that radical changes of plan would be objected to by residents and prospective purchasers, so firmly established are the fixed customs in this regard.

The land surveyors in private practice have more opportunity to bring into play their abilities for designing arrangements appropriate to the intended use of the property but until all development is controlled by adopted schemes or bylaws not much change from the customary practice can be looked for. The engineering profession has a great opportunity for public service in connection with the propaganda necessary to bring the advantages of town planning schemes prominently before the people and the municipal and surveying branches of our profession should lead in this work.

MR. SPEIGHT: We must all admit that the Western provinces have been the pioneers in town-planning; they certainly have led Ontario in that respect. Most of you are aware that a City and Suburbs Act was passed some eight or ten years ago by the Ontario Legislature, but it was repealed in 1917 by the Development and Town Planning Act, a measure which was quite in advance of anything we had had before. Plans or registrations must now be submitted to the city or town authorities, and new streets must conform to those already laid out or projected. If the land speculator or company that wishes to lay out a sub-division cannot get the approval of the city authorities, the matter may be heard before and be decided by the Ontario Municipal Railway Board. This legislation has certainly been of great benefit.

There is another respect in which the Western Provinces are far in advance of us: before a plan is registered they have an inspector go over the work and if it does not conform to certain requirements it must be done over again. I shall have great pleasure in reading this paper when it is printed, and I move that a vote of thanks be tendered to Mr. Beggs for preparing it for presentation at this meeting.

MR. NELLES: In seconding the motion, may I call attention to just three points brought out in Mr. Begg's paper which, I think, are of particular interest to surveyors. Town planning opens up another branch of activity for which land surveyors are peculiarly fitted. I have in mind Mr. Begg's suggestion regarding the appointment of a Provincial Director of Town Planning, who should have under him a number of town planning engineers. The next point is the great harm done to the industrial development of a city through the sub-division into small lots of all the outlying territory. I believe that in Vancouver they have enough sub-divisions for a population of ten million. The fact that the owners of some of these lots live, perhaps long distances away often results in the city losing a valuable industry which. but for the delay in effecting the necessary land arrangements, might have established itself there. The next point is in regard to sunlight. The main streets of Ottawa are so laid out as to get the most advantage from the sunlight. Sparks Street gets the sunlight in the morning and also in the evening—and it is a very narrow street, where the sunlight is needed. So that in laying out townsites the direction of the north line should be taken into consideration and the streets laid out so that they will get as much sun as possible. (Applause.)

THE CHAIRMAN: I take it from your response that it is unnecessary to put the motion.

The meeting adjourned for luncheon.

THURSDAY AFTERNOON SESSION.

The meeting resumed at 2.40 p.m.

THE CHAIRMAN: Mr. Leavitt has come to speak to us on "Some Forestry Problems in Canada", a subject interesting to land surveyors, and one which Mr. Leavitt is well able to handle. We will now hear from Mr. Leavitt.

SOME FORESTRY PROBLEMS IN CANADA

BY CLYDE LEAVITT, CHIEF FORESTER, COMMISSION OF CONSERVATION.

Mr. Chairman, and Gentlemen: I wish first to express my keen personal appreciation of the compliment you have paid me in inviting me to speak to you to-day. I have not a prepared paper on this subject; I shall discuss the matter in a somewhat general way from some notes which I have with me. Of course, the subject is too large to discuss fully in the time that can be allotted to any one speaker at a meeting of this kind.

There is a tendency in many quarters to regard forestry as a sort of fad and to look upon those who are taking up the question of the shortage of timber supplies as alarmists and extremists. But I submit, gentlemen, that having regard to the economic importance of the forests to a country like Canada, it is well worth our while to take some thought for the future and to consider whether the steps that are being taken tend towards the perpetuation of this great natural resource. We all know that nature is wasteful in her methods, and if the knowledge gained by man is not applied in such operations as the exploitation of our forests, a great deal of waste is likely to result. I believe that any Dominion land surveyor would agree, from his observation of the forests with which he has come in contact, that even adequate protection of the forests from fire would not be sufficient to preserve for the future our supplies of the more valuable species of timber. We must exercise more care in the exploitation of our forests; and that, of course, is where the art of the forester comes in. The forestry profession is rapidly becoming recognized as a branch of the engineering profession. The forester, perhaps, must be more or less familiar with more of the natural sciences than men in almost any other profession. If he is to be a competent forester he must know something of all the natural sciences—botany, geology, zoology, chemistry, biology, entomology, plant pathology, and so on. He has to have a knowledge of land surveying as well, for use in connection with his forest survey work. The work of the forester is closely related to that of the Dominion Land Surveyor, and it could be wished that the two professions might come in contact to a greater extent than, perhaps, they have done in the past.

I want to make the point that, just as in other professions, the new graduate in forestry is not a forester to begin with, but a man who, by taking advantage of proper opportunity to gain experience after graduation, may become a forester. The same is true, of course, in the various other branches of the engineering profession.

It is not my purpose to enter into any very technical aspects of the forestry situation. I shall surely give you a little insight into some of the angles of the situation with which the foresters are coming in contact as a part of their regular work to-day.

In the first place, I should like to quote a few figures to show the economic importance of the forests of Canada to-day. We have seen in the papers a great many references to the fact that the balance of trade, particularly with regard to trade with the United States, is very much against Canada; and of course this situation is reflected in the adverse rate of exchange. Now, this is shown by some figures which I have taken from the census statistics for the year ending October 31, 1920. The total imports of all classes of goods into Canada amounted during that year to $1,340,000,000, and our total exports were $1,229,000,000. Taken as a whole, that is not such a very bad showing, but consider the balance with the United States. Our imports from the United States amounted during the year to $923,938,000, while our exports to the United States amounted to $530,125,000. In other words, our exports to the United States amounted to only 57 per cent of the total of our imports from the United States. To turn the thing the other way round: our imports from the United States were 74 per cent. greater than our exports to the United States. Now, of these exports to the United States the total for wood, manufactured and unmanufactured, wood pulp and paper, was $227,386,000, or 18.4 per cent. of all our exports. That, I think, shows the importance of the forest as a basis for our export trade—18.4 per cent. of the total export of Canada to the United States was based on forest products. Contrast that figure of $227,386,000 with the export figures for some of the other items. The total export of wheat from Canada to the United States during the year amounted to $218,032,000; of iron and steel, $61,861,000; of wheat flour, $61,379,000. In other words, the forest products constituted the largest single item in our export trade with the United States— not as large, of course, as wheat and wheat flour together, but larger than any other single item.

Consider the situation as it affects the maintenance of our economic structure at home. Our two great timber industries, the pulp and paper industry, and the lumber industry, do not by any means comprise all the timber industries operating in Canada, because we have other elements such as laths, shingles, railway ties, telegraph and telephone poles, and a large number of other items which come from the forest. But simply taking the pulp and paper industry and the lumber industry together, the value of the combined production would be somewhere around $250,000,000 a year, and the capital investment would be somewhere around $400,000,000. The total payments of salaries and wages during the year would be around $75,000,000, and the number of men working for wages in connection with these two industries would be in the vicinity of 80,000. When we consider these aspects of the situation; when we have regard to the extent to which our economic structure is bound up in the exploitation of the forest, there can be no question that it is worth while trying to make sure that the forests shall be handled in such a way as to make their products available for all time to come rather than for a limited period of time only.

Just a word with regard to the viewpoint of Provincial revenues. The great bulk of the timber lands of Canada are Crown lands and revenues arising therefrom are due to the Crown on account of the licensed timber lands. The province of New Brunswick for the year ending October 31, 1920, received a forest revenue of $1,387,000, just about double the amount that was received during the previous year. The very large increase is due in part to an increase in the stumpage dues and in ground rental and in part, as is stated by the Provincial Government, to the fact that the forest service down there has been able to get a good deal more honest scale than they have ever had before; in other words, they have been collecting dues more nearly proportionate to the amount of timber cut.

The province of Quebec for the last fiscal year received $2,604,000 from its forests in one form or another, while Ontario received $2,685,000. In British Columbia the forest revenue is around $3,000,000 a year. Obviously these forest revenues are a very important factor in the maintenance of the administrative organization of the province. That is one of the great troubles so far as the protection and administration of the forest itself is concerned—the money is so badly needed for other purposes that the Provincial Governments hesitate to spend as much money for the protection and proper administration of the forests as they should if they want to insure their perpetuation. All this is just by way of introduction, to show something of the importance of the forest in the economic life of Canada and to show why the work of the forester may be worth while.

The subject under which I intend to discuss a number of the problems connected with the forestry situation are as follows:

Extent of Forest Resources.
Forest Protection.
Wood Utilization and Preservation.
Reforestation.

The Management or Proper Handling of Forests.

With regard to the extent of the forest resources of Canada the first statement to be made is that we do not know nearly as much about this as we should. There has been a great deal of speculation and a lot of wild guessing; statements have been made by a great many people—especially has this been the case in years past—that our forest resources are inexhaustible and that there is no occasion to worry about the future. On the other hand, we have had alarmist reports to the effect that our forests are in immediate danger of extinction and that the situation is almost hopeless. I think that the truth undoubtedly lies between these two extremes. Nevertheless, we have not enough specific information to enable anyone to state with any very close degree of approximation just what our forest resources are.

The Commission of Conservation has been working on this problem during the past six or seven years. We have made a study of the situation in British Columbia; Mr. Craig and Dr. Whitford, after about three years' work, prepared a report on the forests of British Columbia and this report has been published by the Commission of Conservation. Investigations of the forests of Saskatchewan have been made also by the Commission, but the report is not yet complete, owing to the illness of the author. We hope, however, to be able to get the report ready for publication before very long. In Nova Scotia some years ago the Provincial Government made an appropriation for a survey of the forest resources of that province, and the report on the subject by Dr. B. E. Fernow, of the Faculty of Forestry, University of Toronto, was published by the Commission of Conservation. Mr. Craig, one of the authors of the British Columbia report, is now engaged on an investigation of the forest resources of Ontario. We expect that that work will proceed for another two years We hope that during the coming summer we shall have co-operation from the Air Board and from the Provincial Government which will enable the collection of a great deal of information with regard to forest conditions north of the Transcontinental railway, right across the province of Ontario. Last summer we made some experiments up in the lake Temiskaming district which showed that very valuable information can be secured by observations from the air. Types can be determined quite satisfactorily; you can distinguish coniferous forest and mixed forest and hardwood forest; burns restocked and burns not restocked; muskegs, swamps, and so on; and with this information plotted on a base map you have a very good start towards something that is really worth while. If that information is supplemented by a certain amount of scouting on the ground to get an idea of the average conditions and the average stand per acre, it will be quite possible to get a fairly satisfactory approximation of the conditions of the forest over large areas and within a comparatively short period of time.

New Brunswick has been making a survey of its Crown lands for several years past. They have about seven and one-half million acres of Crown lands, and up to the end of 1920, they had completed a survey of about

42 per cent. of that area. The work is done quite intensively; it is the most extensive project of the kind, I think, that has yet been undertaken on this continent.

Incidentally I should like to make reference to one point as it affects the land surveyors. In looking over the programme of the last annual meeting of this Association I noted a reference in the President's address to the need for cultivation of the faculties of observation and literary ability to record the results of the observation. This certainly is applicable to the statements with regard to various conditions which surveyors are expected to make as part of their report. In connection with our work we have found that the reports made by the surveyors on various conditions have been very helpful indeed. Their value, of course, is in proportion to the extent to which information is incorporated in the report; if the notes are very sketchy they are not so valuable as fuller informationwould be as to the species of trees, their size, and the general conditions. I have no doubt that the statement that was made at your last annual meeting is true, that these notes are not sufficiently used. So far, however, as our own work is concerned, we can testify that they have proved very valuable.

Just a word with regard to the comparative extent of Canada's forest resources and those of the United States. As nearly as we are able to get at the situation, it is probable that Canada has about one-fourth as much saw timber as the United States including conifers and hardwoods; counting both saw timber and cordwood, Canada has nearly one-third as much as the United States. Two-thirds of the forests of the United States may be classed as saw timber and one-third as cordwood; in Canada the proportion is about half and half. These proportions might well be borne in mind in connection with the statement sometimes made in the United States that when their forests are exhausted they can get all the timber they will ever need in Canada.

Forest Protection. The protection of the forest should be considered under at least three heads: protection from fires; protection from insects; protection from fungi. Now, that just goes to emphasize the point I made that the forester has to know something about a good many different things. He comes in contact with the entomological aspect of the situation, and also with the pathological. The damage that is done by forest fires in Canada in an average year can only be surmised. We know that it runs on an average into a great many millions of dollars per year, and that without making very much, if any, allowance for the value of the young growth that is destroyed or for the damage caused to the soil by these fires, especially in midsummer. For example, in Ontario in 1919, about 900,000 acres were burned over; that goes to show that we have not yet reached a very advanced stage of development in our forest protection work. It is true that the great bulk of this area either had been previously burned over or was cut-over land on which there was not a very large amount of merchantable material; nevertheless there was destroyed a large amount of under-sized material and of young forest growth which had a very large prospective cash value.

Taking the situation as a whole, I think there is no question that the efficiency of fire protection work has increased materially during recent years. Even yet, however, there is not sufficient recognition of the urgent need for really adequate forest protection.. Governments are not spending as much money for this purpose as they should. In years past, fire protective organizations were quite seriously hampered by political patronage; and, as I have already stated there has been a heavy demand on the forest revenues for the purposes of general administration in the various provinces.

We find from studying the statistics that the main causes of forest fire are lightning, hunters, fishermen, smokers, camp fires generally, settlers' clearing fires, and the railways. So far as railway fires are concerned the railway Commission has taken hold of the situation and has had in effect since 1912 fire regulations which require the railways to patrol their own lines in forested sections and to be responsible for extinguishing fires caused by railway locomotives. The inspection connected with this phase of the work is handled by the Board of Railway Commissioners in co-operation with the respective Dominion and Provincial organizations which are handling forest protection generally. These local men are designated as local officers of the Board ex officio and carry on the inspection as part of their regular work. Very good results have been secured, and there is no question that the damage from railway fires has been very materially reduced. The legislation which led up to these regulations was enacted at the instance of the Commission of Conservation, the British Columbia Government, and the Dominion Forestry Branch, and the work is being administered under a co-operative arrangement between the Board of Railway Commissioners and the Commission of Conservation.

The patrol systems which are in effect in the different provinces vary somewhat. In all provinces except Quebec the work is handled by the Provincial Forest Service direct. In the province of Quebec there are co-operative forest protective associations, organized by the limit-holders or timber owners, who work in co-operation with the Provincial Government. The timber owners are assessed by the associations on a basis of acreage and the manager of each association hires his own men and handles his own work. Outside of the territory patrolled by the associations in Quebec the Provincial Government maintains a patrol staff.

In a number of the provinces experiments have been under way with regard to patrol by air craft. The St. Maurice Forest Protective Association in Quebec was the leader in this movement, and it has extended to some extent. The Air Board have in their program for the coming year the conduct of some further experiments along this line in a number of different provinces in co-operation with the respective Provincial Governments.

One of the important considerations in connection with forest protection is the problem of slash disposal. It has been the general experience that the destructive fires almost invariably occur on the cut-over lands where the slash from lumbering operations has been allowed to remain on the ground. There has been a good deal of discussion as to whether it would not be both necessary and feasible to require lumbermen to dispose of their logging slash, primarily from the viewpoint of decreasing the fire hazard. Not a great deal of progress has been made in that direction as yet, the cost, of course, being the great obstacle. I believe, however, that the time will soon come when some definite action will have to be taken along this line. It may not involve the complete disposal of logging slash on all cut-over areas, but it certainly should include the disposal of slashings around the exterior boundaries of cutting areas so as to afford a vantage point from which fires originating in the cut-over areas can be controlled and kept out of the green standing timber. Perhaps also where the cutting is very heavy and the amount of slash would be so large as to hinder the growth of the under-sized timber and interfere with reproduction, it may be necessary to require that at least a part of the slash be disposed of by burning. In a very heavy stand you may have slashings covering the ground to a depth of perhaps two or three feet in extreme cases. It is quite obvious that the young forest growth does not stand much chance on such an area, quite aside from the strong probability that sooner or later that slash will catch fire and cause the destruction of everything within reach. Experiments that have been carried on in Alberta by the Soldier Settlement Board along the line of controlled burning are very interesting in this connection. These experiments appear to have demonstrated quite satisfactorily that with proper organization fires can be controlled. There are now available portable fire-fighting pumps which should assist very materially in controlling fires of this character where water is available within easy reach.

Just a word or two with regard to insect damage. The amount of damage that is done in our forests by insect enemies is by no means generally appreciated. The probabilities are that insect damage annually totals at least as much as the damage by fires. The Dominion Entomologicl Branch has for years been studying this aspect of the situation and some progress toward actual control is now beginning to be made particularly in British Columbia. In our eastern provinces the most serious insect pest at the present time is the spruce bud worm, which has caused very heavy damage in our pulpwood forests. The balsam is much more seriously injured than the spruce; it would be proper, I think, to call this insect the ''balsam bud worm'' rather than the ''spruce bud worm'', because he apparently likes the balsam foliage much better than the spruce. It is probable that this insect has destroyed around one-fourth of the balsam timber in Quebec, and perhaps one-third of the balsam timber in New Brunswick. How many millions of dollars that will run into has not yet been figured out, but most certainly the damage to the lumbering and pulp and paper industries and the loss of revenue to Provincial treasuries will run into a great many million dollars. Another insect pest is the white pine weevil, which causes a great deal of damage to the white pine forests.

The question of slash disposal is also an element in the situation with regard to these insect pests. The Entomological Branch has expressed the opinion that quite aside from the necessity of slash disposal from the viewpoint of fire protection, it ought to be required from the viewpoint of preventing the spread of these insect pests. The decaying slash forms a breeding ground for the insects; of course, they breed and spread very much more rapidly under these conditions than they would in the virgin forest.

Tree Diseases. This also is an element of damage to our forest about which most people know very little. It includes, of course, all the different kinds of rot which affect the standing trees. Not very much has been done in Canada in the way of investigating the fungus diseases of trees; there has been so great a demand for investigations looking to the control of diseases affecting farm crops that the pathologists have not had time to go into the forest. Further, there is the point that even if they knew everything about the life history of these fungi, only to a very limited extent would it be possible to control the spread of these diseases. The only way that they could be controlled would be by logging out the timber affected by the disease, and of course you cannot carry on operations all over Canada at one time, or even within any limited period of years, with a view to getting rid of the affected trees.

The white pine blister rust is one of the diseases which threatens to cause considerable damage in our white pine forests. It has already secured quite a firm foothold in a number of the northeastern States and is established in Ontario, and, to a certain extent, in Quebec. No very heavy damage has yet been done in Canada to the pine timber, but the situation is serious enough for the future. The disturbing feature of that situation is the fact that this blister rust destroys the young growth much more readily than it does the mature timber, so that we are likely in sections where the blister rust gets established to have to eliminate consideration of the white pine as an important factor in our forests.

One disease which has caused a great deal of damage is the balsam butt rot. Some study has been given to that, but only to a limited extent is it possible to control it, and that only by logging where affected trees are found. According to the report which was made by Dr. W. H. Rankin for the Commission of Conservation, the outlook for the future may be somewhat encouraging so far as this disease is concerned. Dr. Rankin found that the disease does not affect the more rapid-growing trees on lands which have been cut over as much as it does the slow-growing trees in the virgin forest. In other words, timber of slow growth is more susceptible to damage by the balsam butt rot than is timber of more rapid growth, such as takes place on the cut-over lands where the trees have more light.

Another angle of the situation which the forester has to consider is wood preservation and wood utilization. I will only say as to that that if you can make the timber that grows on an acre of land go twice as far or last twice as long as it otherwise would, you have accomplished the same object as if you had doubled the production of that acre. There are many problems connected with the closer utilization of our woods: the discovery of substitutes for woods which have become scarce; the lengthening of the life of timbers by preservative treatment, and so on. The Dominion Forestry Branch has a laboratory at Montreal which works in co-operation with McGill University, and they have been devoting a great deal of attention to these aspects of the situation. For example, formerly the pulp and paper people thought they could use only spruce in the manufacture of newsprint, but it was demonstrated that balsam also would be used to a limited extent. Finally they found, when spruce became more scarce, that they could use balsam to an even greater extent, and then that they could even make very good newsprint with nothing but balsam. There are other species which are undoubtedly going to prove valuable in connection with the pulp and paper industry. Poplar is already used to a considerable extent in the manufacture of book papers and jack pine for wrapping papers. Recent developments indicate that jack pine can be used quite satisfactorily for newsprint. The Laurentide Company have made some experiments tending to prove that groundwood from yellow birch can be mixed, up to ten per cent, in the manufacture of newsprint. If yellow birch can be used satisfactorily for newsprint the practice of forestry on our lands will be tremendously helped, because in Ontario the yellow birch, which grows over great areas in that province as well as in Quebec, is practically a weed tree; it holds back the growth of the spruce and the balsam, and so far the market for it has been limited. The difficulty in the past has been one of transportation, for hardwood cannot be readily driven in the streams for any great distance, and the result has been that this weed species has been left standing in the forests and the more valuable species have been cut out. The effect of that, of course, is that we are constantly depreciating the quality of our forests instead of improving it, as should be the case.

Just a word with regard to tree planting. Almost no tree planting has been done as yet by the Provincial Governments. Ontario is apparently on the point of embarking on reforestation on a considerable scale. Both Ontario and Quebec have large Provincial nurseries which have been used primarily in the past for the growing of planting stock for sale to the pulp and paper companies and for the furnishing of trees to farmers for farm planting. Quite a number of the pulp and paper companies in Ontario and Quebec are starting schemes of reforestation. The Laurentide Company is the pioneer in this respect. The Riordon Company have done a good deal of planting, and the Abitibi Company is starting.

The question of the proper handling of our forests is a big enough topic upon which to spend a whole afternoon. The situation in Canada for the practice of forestry is much more favourable than it is, for example, in the eastern United States because of the fundamental fact that the great bulk of our timbered area is still in the hands of the Crown, and the licenses which have been issued for the cutting of this timber provide that the several

Governments shall have the right from time to time to prescribe the conditions under which the cutting shall be done. I do not think it can be stated that we have made very much progress as yet in the direction of actual forestry practice. We have in Quebec and New Brunswick diameter limit regulations prohibiting the cutting of timber below a specifiied diamater. We have such regulations in Ontario, but only to a very limited extent. From the forester's standpoint, such regulations, while very much better than no regulations at all, do not constitute good forestry practice, for the reason that a great deal of timber may be left on the ground under the diameter limit system of regulation which ought to be cut, and in other cases timber which ought to be cut is left standing. What we need is a careful study of each area which it is proposed to cut over, this study to be made by foresters of wide experience and thorough training who are competent to make recommendations for the measures to be taken. The forestry profession has not yet been so far developed in Canada that a sufficient number of men are available to carry on work of this kind on an adequate scale. Each Provincial Government has only a few trained foresters. The Dominion Forestry Branch has the largest organization, and even that organization is still inadequate for the task which faces the Forestry Branch. The Forestry profession, therefore, is still very much in its infancy. We believe, however, it is going to grow in the future. and that it wil prove of great value to the country.

One thing which must be recognized in connection with the practice of forestry is that the economics of the situation must always be taken into consideration. For example you cannot expect a pulp and paper company to carry out measures of forestry practice unless after the work is done a reasonable margin of profit is left for the company. That means that the governmental agencies responsible for the administration of these lands must use great care in prescribing measures which the companies must carry out. They should always have regard to the financial situation and be reasonable in their requirements.

I have a lot of other material here, Mr. Chairman, but I think I have talked long enough. I will conclude by thanking you very much for your kind attention. (Applause.)

MR. HERRIOT: I have great pleasure in moving a vote of thanks to Mr. Leavitt. If every member has listened with the same pleasure that I have, Mr. Leavitt has been amply rewarded for the effort he has put forth. (Applause.)

THE CHAIRMAN: Mr. Leavitt, you have heard the response to that motion.

MR. LEAVITT: Thank you.

THE CHAIRMAN: One thought that Mr. Leavitt brought out, the desirability of closer co-operation between the foresters and the surveyors, is one that both foresters and surveyors might keep in mind.

THE CHAIRMAN: Gentlemen, the next item on our programme is the paper by Mr. Johnson entitled "Special Cases of Dominion Lands Survey". Mr. Martindale will read this paper.

The paper is not included here as it has been published by the Alberta Surveyors.

Mr. Nelles submitted the Report of the Geodetic Committee and moved its adoption. Carried.

REPORT OF THE COMMITTEE ON GEODESY

BY DOUGLAS H. NELLES, CHAIRMAN OF COMMITTEE ON GEODESY.

1. **Geodetic Work.** Geodesy means precise measurement of the earth. The name is derived from the Greek words meaning "the earth" and "to divide". It is therefore the science and art of measuring portions of the earth's surface by means of triangulation, levelling, Laplace observations; the determination of the figure of the earth, its density and lines of magnetic force; measuring and showing the configuration or modelling of the surface of the earth by means of precise contour maps. In the United States the geodetic work is carried on by the United States Coast & Geodetic Survey, in Great Britain by the Ordnance Survey of Great Britain, in India by The Survey of India and in Canada by the Geodetic Survey of Canada.

2. **Triangulation.** Triangulation is divided into three classes: primary, secondary and tertiary according to the precision desired and the methods used. Triangulation in Canada is based upon what is called "The North American Datum", which was originally called "The United States Standard Datum", but upon being adopted by Mexico and Canada the name was changed as above. In the annual report for 1920 of the Director of the United States Coast & Geodetic Survey the following statement occurs:—

"An approximate position of a survey may be obtained by astronomic "observations, but the latitudes and longitudes of such a survey may be in "error by as much as one-fourth or one-half a mile, due to the local attrac- "tions of the mountain masses on the plumb line, to which all astronomical "observations are referred". The North American Datum was determined from the result of over 600 astronomical observations, so that in adopting this datum Canada has been saved years of time and a vast amount of money.

The policy of the Geodetic Survey of Canada has been to extend the triangulation of Canada over the more thickly settled portions first and then over the more thinly settled portions and at the same time to attend to special requirements of the country outside routine work as the need arose. Among the several hundreds of applications for information from Government departments, private individuals, corporations and cities, were cases, where special work had to be undertaken, such as the triangulation of the cities of Halifax, St. John, Montreal, Ottawa, London and Vancouver district.

3. **Laplace Observations.**....In connection with the primary triangulation of Canada some 19 Laplace stations have been established in different parts of the Dominion by the Geodetic Survey. When a system of triangulation is carried several hundred miles there is a tendency for it to twist or swing away from its true position. The information obtained from the observations obtained at a Laplace station enables this twist to be corrected. In the Laplace equation the longitude and azimuth are both affected by errors due to the deviation of the plumb line mentioned above, but in this case the terms involving these errors balance, and hence leave the results free from errors due to this cause.

4. **Levelling.**....Levelling is divided into two and sometimes three classes, precise, secondary and tertiary according to the precision obtained and the methods used. The Geodetic Survey of Canada has up to date a precise level net extending all over the settled portions of the Dominion, consisting of 14,031 miles of double line. This net is connected with tidal gauges at Halifax, Yarmouth, St. John, Father Point, Vancouver and Prince Rupert. It is also connected with five bench-marks of the United States net in Eastern Canada and with six in the west. Other branches of the Government have, as we have seen from Mr. Montgomery's paper this morning, done precise levelling in certain localities.

The results of precise levelling have been published as the work progressed, but no adjustment had been attempted up to 1919. In 1920 enough circuit closures had been made to make a net adjustment by least squares desirable, with the orthometric correction also taken into consideration. The Geodetic Survey has now completed the first preliminary adjustment of the precise levels of western Canada; the adjustment of this net when completed will include the results of the precise levelling done by the Topographical Survey Branch. The precise level net of Eastern Canada is now in progress of adjustment. In this net the average orthometric correction of some thirty circuits amounts to 0.146 feet.

5. **Mapping.** A rather interesting experiment was undertaken by the Geodetic Survey last summer in regard to finishing the map of some 107 square miles of country in the Gatineau valley in which the information needed was the contours of the hills. The hills were low and covered with thick forest, which rendered the country unsuitable for intersection phototopography. The stereophotogrammetric surveying apparatus belonging to the University of Toronto was kindly lent to the survey for a practical experiment in the field under conditions that would test its usefulness to the utmost. The stereophotogrammetric method has been so ably described by Capt. W. C. Murdie in a paper read before this association in 1915, that it is unnecessary to enter into details here. Excellent results were obtained in the field, and the plotting is being started in a few days from this date.

The policy of making precise large scale maps of Canadian cities and towns has been initiated by the Geodetic Survey during this last year and a contract has been entered into with the city of London, Ont., for a precise map of that city. The system of survey consists of a city triangulation net based on the Geodetic triangulation, a precise level net based on the precise level net of Canada, secondary level net adjusted to the precise net which will tie in all city bench marks, and establish the elevation of all triangulation and traverse stations; a traverse net adjusted to the triangulation, which will leave a station marked by a copper bolt on one corner of each street intersection. This framework will serve to establish and permanently mark the position of all natural and artificial features of the city such as is shown on the large scale city maps of Great Britain, made by the Ordnance Survey. The data obtained in the survey of London as to cost, etc., will serve to determine the future policy of the Government in this regard.

6. **Explorations.**....During the past year the Geodetic Survey of Canada was asked by the Naval Service Department to calculate and adjust the results of the Canadian Arctic Expedition under the command of V. Stefansson and to make maps of the country explored showing the coast lines surveyed by the expedition. Some 300 astronomical observations have been reduced and adjusted, and 1000 miles of coast line plotted. This work is now nearing completion.

ELECTION OF OFFICERS.

THE CHAIRMAN: The following is the Report of the Scrutineers in the matter of the Election of Officers for the ensuing year:

Scrutineers' Report.

For President	G. H. Blanchet,
Vice President	G. H. Herriott,
Secretary	W. L. MacIlquham.
Ottawa Councillors	(W. M. Dennis, (P. E. Palmer, (J. J. Stock, (R. C. Purser, F. H. Kitto.
Councillor for Quebec and .... Maritime Provinces	M. D. McCloskey.
Councillors for Ontario	(A. L. Cumming, (T. H. Bartley
Councillors for Manitoba	(W. J. Deans, (C. B. Donnelly, (J. W. Harris, —Tie.

Councillors for Saskatchewan (J. E. Morrier,
(J. E. Underwood,
(A. C. Garner, —Tie.

Councillors for Alberta .... (A. G. Stewart,
(H. E. Pearson.

Councillors for British ....
Columbia .... (R. B. McKay,
(J. E. Ross.

Number of Ballots cast	121
Spoiled Ballots	9

Scrutineers .... G. A. Bennett.
.... G. C. Cowper

Ballots were taken at the meeting for the following ties:
Councillors: Manitoba—Donnelly, Harris;
Saskatchewan—Underwood, Garner.

whereupon Mr Donnelly for Manitoba and Mr. Underwood for Saskatchewan were duly declared elected.

At 5 p.m. the meeting adjourned until Friday morning at 9.15 o'clock.

In the evening a large audience assembled in the Collegiate Institute Hall to hear Mr. Charles Camsel, Deputy Minister of Mines, lecture on the Mackenzie River oil fields and to see the splendid pictures of that country as shown and explained by Mr. F. H. Kitto, D.L.S..

During the evening several song selections were given by the Topographical quartette, comprised of Messrs. W. J. Boulton, G. H. D. Gibson, R. J. Dawson, and W. R. Burrill.

MACKENZIE RIVER OIL FIELDS.

BY CHARLES CAMSELL.

Canadian newspapers of last October contained the announcement of a discovery by the Imperial Oil Company of crude petroleum in a well situated on the Mackenzie River near the Arctic circle in the far northwest of Canada. Although this well is situated over 1000 miles from the nearest railway in a country almost uninhabited, and where there is no market for the oil, the discovery has created a surprising amount of interest all over the continent as well as in Great Britain. Few events that have happened in the mining industry since the Klondyke was struck in 1897 have created as much stir among mining men, and if prompt action had not been taken by the Government to discourage entry into that country except by those properly equipped there might have been a repetition of some of the conditions of '98 when many fortunes and lives were lost in the attempt to reach the mining fields.

The discovery of oil in the Mackenzie district is, however, a different thing from that of gold in the Klondyke. The one was a poor man's opportunity to make a fortune by digging it out of the ground by his own unaided effort. This is a proposition which requires the expenditure of a very large amount of capital before any returns are obtained, and, therefore, is one for the large oil companies to undertake.

Ten years ago a discovery of this kind in that locality would have been of no interest whatever, in fact no one would have been foolish enough to go up there to drill for oil. To-day it attracts the attention of the world, due to the oil situation throughout the world and of this continent in particular.

The significance of this discovery is, however, not as yet fully understood by the people of Canada, and its importance will only be appreciated gradually for the development of the field cannot be other than slow, and it will probably be some years before the oil is marketed in our Western cities.

The oil situation of the world and of this continent is becoming more and more acute. It is considered serious at the present time in the United States where about 70 per cent of the world's supply is produced and for Canada it is very much worse. The discovery, therefore, for us is very opportune.

Let us look at this situation for a moment.

It was well said that the Allies floated to victory in the war on a sea of oil. It is needless to point to the important and indeed indispensable part that oil plays in the trade and commerce of the world for much has been written on the subject in recent months, and its importance, is, therefore, fully appreciated. This part is a rapidly expanding one and producers are finding it more and more difficult to meet the demands of consumers. Production is not keeping pace with consumption and reserve stocks are being drawn upon and are gradually diminishing. Not only are individuals and companies making strenuous efforts to discover and develop new sources of supply in all parts of the world, but their efforts are being supplemented by governmental aid. The world must have more oil, and money and efforts are not being spared to find it.

The world's total production of crude petroleum in the year 1918 was 514,729,354 barrels and was obtained from 17 countries in the following proportions:

United States	69.15 per cent.
Mexico	12.40 " "
Russia	7.86 " "
Dutch East Indias (including British Borneo)	2.58 " "
Roumania	1.70 " "
India	1.55 " "
Persia	1.40 " "
Galicia	1.09 " "
Peru	.49 " "
Japan and Formosa	.48 " "
Trinidad	.40 " "
Egypt	.40 " "
Argentina	.26 " "
Germany	.14 " "
Canada	.06 " "
Venezuela	.03 " "
Italy	.007 " "

It will be noted from this table how small is Canada's production, and also that the total production of the British Empire is only about 2 per cent. of the world production. In fact the total production of the British Empire is not sufficient to meet the consumption in Canada alone.

Full figures of production for the last two years are not yet available for all countries, but since the United States produced in 1919 about 22 million barrels more than in the preceding year, while no other country showed any very marked rate of increase, her percentage of world production for that year must be considerably greater and Canada's correspondingly less. The United States is believed to have reached the peak of her production in 1920 and a decline is forecasted, which will probably continue for the future. In spite of her large production the United States consumes more oil than she produces, her consumption being in 1918 about 75 per cent. of the world's production. Consumption too in that country is increasing at such a rapid rate that her people are becoming alarmed and are contemplating legislation against exports that will seriously affect this country. That alarm is thoroughly justified when they consider the reserves of crude petroleum that they have to draw upon in their own country.

Careful estimates made by David White, Chief Geologist, of the United States Geological Survey in January, 1919, place the quantity of well oil under ground in the United States recoverable by present methods of production at 6,740 million barrels, and without taking into consideration the rate at which consumption is increasing this reserve is only equivalent to **about 17 years supply.** This does not mean that this whole supply of oil in the United States will be exhausted in 17 years because production in any field cannot always be maintained at a maximum until total exhaustion, but proceeds at a gradually diminishing rate. It does, however, mean that foreign sources of supply will have to be drawn on to a greater and greater extent, and exports of domestic oil curtailed or cut off altogether either through legislation or lack of the material to export.

This condition has recently been drawn to the attention of Congress by a Federal Committee and certain recommendations made which may be adopted in the near future. These recommendations include the restriction of the use of oil to certain purposes only, the encouragements by diplomatic support of the development of foreign fields by American companies, and the curtailment of exportation of domestic crude oil and its products. The last recommendation is the one most likely to be put into effect by Congress and is one which will seriously affect this country. There is already a shortage of fuel oil on our coast of British Columbia, which has come about, not through legislative action in the United States, but through a shortage at the source of supply in California.

Let us now look at the condition of the oil industry in Canada and how the situation in the United States is going to affect us.

Canadian oil production comes from three fields, namely, New Brunswick, Southern Ontario and Alberta. The Southern Ontario fields have been producing for nearly sixty years and to-day are responsible for over 90 per cent. of the whole Canadian production. In 1919 our total production was **240,970 barrels,** an amount, however, which supplied only about 2 per cent. of our requirements in fuel, motor, lubricating and illuminating oils. Our total consumption of pretoleum and its products was over **13 million barrels,** of which about 98 per cent. was imported. We are indebted to the United States for over 93 per cent. of the oil imported, while Peru supplies our market on the Pacific to the extent of the remainder. Those figures indicate our dependence on our neighbours to the south, and the bearing that their oil situation has on ours.

Like the United States our consumption of oil has been increasing year by year and the increased consumption has been met not by greater production from our own fields, but by annual increases in the amount imported from foreign countries. What then would be the position of those of our industries and operations that are dependent on an oil supply if our greatest source of supply is cut off altogether ?

To be dependent on foreign countries for such an essential resource as oil is a very unsatisfactory and even dangerous position and it requires no argument to show the necessity of developing such domestic supplies as will at least meet our own requirements. Geological investigations seem to show that no considerable measure of relief is to be expected by greatly increased production from the Southern Ontario fields, and although prospecting for oil in Alberta has been carried on for several years results are slow in being obtained. There are of course the enormous deposits of bituminous sands in the Athabaska river and the oil shale beds of New Bruswick and Manitoba, but both of these are dependent on suitable and economical methods of extraction being devised. The oil fields of the basin of Mackenzie river appear to offer some chance of an ultimate solution of our oil problem. It is, however, not an immediate solution because of the remoteness of the fields and the lack at present of any adequate transportation facilities either by rail. water or pipe line.

The well near Fort Norman struck by the Imperial Oil Company last August was reported to have a flow of 1200 or 1500 barrels a day of a high grade oil, and the depth at which this flow was obtained was about 800 feet. Fort Norman, however, is only a few miles south of the Arctic circle and about 1100 miles by river from the end of the nearest railway at McMurray. Since, however, navigation is obstructed at one point for a distance of 16 miles and steamers cannot go right through, the discovery can have no immediate effect on our oil situation and not until some means of transportation are provided. It has, however, a very great significance for the future since the rock formation in which the oil has been found covers a very large area between Great Slave Lake and the Arctic Ocean, and it is reasonable to expect that in places throughout that area where geological conditions are favourable other fields will be discovered than that at Fort Norman.

In order that you may be able to appreciate more clearly the conditions under which the oil occurs and the significance of the discovery at Norman let me give you in the briefest possible form an outline of the topography and geology of the basin of the Mackenzie River.

The Mackenzie River is the eighth largest river in the world, and is exceeded in length and drainage area only by the Mississippi on this continent. It drains an area of 682,000 square miles or about one fifth of the whole of Canada exclusive of the Arctic islands. Its volume near the mouth has been estimated at about 500,000 cubic feet per second.

The basin of the river includes within its boundaries three main physiographic provinces—each of which extends almost the whole length of the basin. The three provinces are these, namely, a rugged mountainous region on the West which is a continuation of the Rocky Mountains, a relatively more subdued but rocky and partly treeless plateau on the east, which is known as the Laurentian plateau, and between these two a broad almost level forested plain through which the trunk stream flows northward to the Arctic ocean. This plain is the northward extension of the Great Plains of Western Canada which in the south where crossed by our railways is about 1000 miles wide, but in the north decreases gradually to about 200 miles in width.

The rocks of the mountain province of the basin consist of highly folded sediments of Palaeozoic or later age.

The rocks of the Laurentian plateau are still older and are similar in character and composition to those of northern Ontario and Quebec.

The central plain is underlain throughout by sedimentary rocks which in the north are mainly of Devonian age, and these are covered to the south by still younger rocks of Cretaceous age.

From the point of view of oil development the central plain is the most important, since the oil obtained at Norman comes from rocks of Devonian age. These rocks in the central plain extend from the lower part of Peace River northward almost to the Arctic ocean. They are assumed to cover an area of about 150,000 square miles and consequently the field in which prospecting for oil might be carried on is a very large one.

It must, however, be clearly understood that though rocks of Devonian age cover this great area, and these rocks are the source of the oil, oil can only be expected to occur here and there throughout it, where the composition and structure of the rocks are favourable for the accumulation of oil in underground pools. The selection of these favourable localities is the work of the geologist. A good deal of geological exploration has already been done, but much remains to be done before we can say where drilling might be carried out with some chance of success.

Promiscuous staking of oil claims will no doubt be carried on to a considerable extent if and as soon as the embargo by the Government is lifted. It cannot, however, be too strongly emphasized that the intelligent location of a site for drilling operations cannot be undertaken satisfactorily except by a geologist, and one familiar with the sequence and character of the rocks and the general conditions under which oil occurs in any particular region.

The general conditions of oil development everywhere, and the particular conditions in the Mackenzie River are such that it is possible only for financially strong companies to operate these successfully. This is not a one man or a small company proposition. It is very different to the Klondyke in that respect. The cost of drilling a shallow well of about 1000 feet runs anywhere from $8 to $20 per foot in the settled districts of the country, but in the Mackenzie district 1000 miles from a railway, the cost would be several times those figures. Oil development, therefore, in the Mackenzie country can only be undertaken by the large companies who will be prepared to spend millions before getting any returns.

Springs of oil occur at several points along the Mackenzie valley from Great Slave lake to the Arctic notably on the north shore of Great Slave lake, near Fort Norman and at Fort Good Hope and Peel river.

First mention was made of these in 1826 by Sir John Franklin on his second voyage to the Arctic. He describes the springs near Norman and at Garry island. Up to quite recent years the Hudson's Bay Company every year collected tar from some of these springs for use as a pitch for their York boats.

The significance of these and other surface indications was, however, not understood nor appreciated until Mr. McConnell of the Geological Survey made his reconnaissance of the river in 1888. McConnell describes the tar springs at Great Slave lake and elsewhere and refers also to the outcrops of bituminous shales on the banks of the river near Fort Norman.In writing of the oil possibilities he stated that the Devonian rocks are nearly everywhere more or less petroliferous and over large areas afford promising indications of oil in workable quantities. He also stated that the possible oil bearing country along the Mackenzie valley is almost co-extensive with that of the valley itself.

It is 33 years since attention was drawn to the oil possibilities of this country by officials of the Government, but because of its remoteness and the great supply that was being obtained from the oil fields of the United States no attention was paid to it.

Conditions, however, have changed within the last five years. The war brought a realization to the nations of the earth of the national importance of petroleum, and all the larger nations have set about to secure for themselves a sufficient supply for their own needs. People have come to appreciate too that oil fields are not inexhaustible, and they should be carefully conserved. Even the United States, a country that produces more oil than all the rest of the world put together, has come to appreciate the necessity of conserving her own supply and of securing new sources of supply. All this has resulted in a feverish scramble for the control of the undeveloped oil fields of the world, and explorations have been undertaken in various parts of South America, Africa, India, Persia, and wherever there were any geological evidences that oil might occur—even in England.

This condition has caused attention to be directed to the basin of the Mackenzie River, and claims were first staked in 1914. This condition is also responsible for the great interest that has been taken in the discovery by the Imperial Oil Company of the well near Norman last year. It has perhaps led people to place a greatly exaggerated value on the Mackenzie field as a source of oil. Some people appear to believe that oil is to be obtained anywhere and everywhere throughout the basin of Mackenzie river, and a drill hole anywhere will strike a gusher. This is not the case. It is true that as McConnell said, the Devonian rocks are nearly everywhere petroliferous, but it has required the operation of certain geological processes of rock folding to allow the oil that is widely but sparingly disseminated through the rocks to accumulate in underground pools.. It may be that these pools will only be found here and there at widely separated intervals, and it will require a great deal of careful geological exploration to locate these particular points, where drilling might be carried on with some chance of success.

These points should be borne in mind; that oil prospecting is pre-eminently the work of a geologist, and that oil development in that remote country can only be undertaken by companies capable of spending enormous sums of money. After oil has been obtained in a sufficient number of wells, the problem of transportation of the oil will then arise. This will also require the expenditure of millions of money before the oil is brought to market.

It will be interesting to Dominion Land Surveyors to note that the first suggestion of a solution of this problem was made by William Ogilvie in 1888, when he suggested tank steamers on the Mackenzie River and a pipe line 90 miles in length across McDougald pass at Fort Macpherson to carry the oil over into the waters of Yukon river and thence to Bering sea. A charter is being asked for now to put this suggestion into operation..

Interest in the oil of that country will also attract attention to its other mineral resources. These are, as yet, very little known since a great part of the country it still unexplored. We do know, however, that beds of gypsum occur at a number of points and frequently in association with common salt. Lead and zinc deposits occur on the south shore of Great Slave Lake. Placer gold in small quantities has been reported in some of the streams flowing into the Mackenzie from the West, and other metallic minerals are known to occur in unknown quantities.

Coal occurs in seams near Fort Norman and on Peel river and, no doubt, other deposits will be found as the country becomes opened up.

FRIDAY, FEB. 4th—MORNING SESSION.

The meeting resumed at 9.20 a.m., the President, Mr. Seibert, in the chair.

MR. HAWKINS, for Mr. Seymour, submitted the report of the Town Planning Committee, and moved that it be received. Carried.

MR. AKINS submitted the report of the Land Settlement Committee, and moved that it be received.

FEDERAL LAND SETTLEMENT POLICY

Introduction.

During the present period of reconstruction and readjustment of our industries, vigorous steps are necessary to develop to the greatest advantage our various resources. The large areas of land, settled and unsettled, constitute our greatest asset. Our resources in agricultural land are so abundant, that, heretofore, too little attention has been given to their co-ordinated development. The time is opportune for the formation of a national land settlement policy having in view the settlement of our idle agricultural lands and the consequent stimulation of all industries.

The settlement under federal supervision of considerably over three million acres of land by returned soldiers has been watched with keen interest by the Dominion Land Surveyors' Association, many of whose members have taken an active part in this work. The Association, after careful consideration, have reached the conclusion that the work of general land settlement should be carried on by a board with powers considerably broader than those of the Soldier Settlement Board, but working along similar lines.

Need of Land Settlement.

For many reasons this is a very favourable time to adopt a federal scheme of land settlement. The per capita amount of our national debt of about eleven hundred dollars for each producing individual is a very large one and constitutes a heavy burden. One of the most desirable methods of reducing this per capita indebtedness is to increase the producing population. Such a population would find, in the development of the land, the greatest benefit to themselves and to the country at large.

If the government railways are to be placed on a paying basis and railway rates are to be eventually reduced, a greatly increased tonnage is necessary. This can be best supplied by the settlement of our vacant agricultural lands. Such settlement would materially increase our production and at the same time furnish a wider market for our manufacturing industries both of which will result in an increase of freight. It is well known that only a small proportion of our agricultural lands is at present occupied and cultivated. It is conservatively estimated that in the three western prairie provinces alone there are 25,000,000 acres of unoccupied agricultural lands within twenty miles of existing railroads. The success of our national railways depends very largely on the development of these vacant lands.

The following is an extract from an article in connection with the Western Canada Colonization Association, appearing in "Canadian Finance", December 1, 1920:

"The settlement of 20,000,000 acres of lands in Western Canada during the next few years would have far-reaching effects. Divided into approximately 100,000 farms it would mean an influx of 100,000 farmers with their families. The average family numbering five—we should, therefore, have 500,000 persons added to our agricultural population. It is found that the agricultural population of a country needs an equal population in industrial life which means an addition of 500,000 to the population of the cities, towns and villages of Western Canada."

The increase in national wealth which would result from the accomplishment of the aim of the Western Canada Colonization Association may be summarized as follows:—

New wealth brought in by settlers	$150,000,000
Net worth of new farm production in perpetuity	1,875,000,000
New capital attracted from abroad for industrial undertakings	75,000,000
Worth of new wealth resulting from profits on handling new farm production	500,000,000
Total	$2,600,000,000

Besides, there would be the wealth created by the thousands of new non-agricultural immigrants who would accompany the influx of farm settlers.

From our intimate knowledge of conditions in the West, we consider these figures a very fair estimate of what would result from the settlement of these lands. Similar illustrations might be given of the benefit of settlement in other parts of Canada.

Need of Land Settlement Board.

While the increase of our rural population is essential, careful discrimination is required in the selection of settlers. Farmers' sons are the most desirable class of settlers and the problem of retaining them on the land by creating conditions, favourable to profitable and successful farming, would assist very materially in checking the movement from rural to urban centres. This would serve to relieve the unemployment situation in the cities. There is also great need of farm labourers who propose to follow farming as an occupation. This class of settler, could, in a few years, obtain the capital and experience necessary to enable them to start farming on their own account. Special attention should be given in our immigration policy to obtaining settlers with the capital and experience necessary to start farming operations, unassisted.

The success of a settlement depends very much upon the rapidity with which it is developed. At present the complete settlement of an area extends over a long period due to the lack of a controlling force in its development. This results in many years in which the settler's earning capacity is very limited and living conditions, social, educational and economic, are far from desirable. Settlement of the newer districts under these conditions, is, therefore, a discouraging undertaking. The development of large areas of new land, in the initial stages, is not an agricultural operation, but rather an engineering problem. Land development should be undertaken as a scheme extending over large areas rather than as a multitude of small unrelated operations by inexperienced men without direction or assistance.

The regulations governing the present system of disposal of crown lands by homestead entry has developed many weaknesses. The homesteader has very often been a land speculator on a small scale rather than a bona fide settler or farmer. The practice of indiscriminate homesteading has resulted in scattered settlement and retarded growth leaving many with insufficient social educational, and economic opportunities. Many settlers through lack of supervision have been permitted to locate on land which was entirely unsuitable for farming and were forced to give up after a few years of discouraging effort. Frequently unqualified men with no experience in farming operations and often without finances, have been permitted to settle and, in many cases, have been encouraged to do so. These cases have generally terminated in absolute failure. Also, settlers experienced in farming under certain conditions have been allowed to settle areas in which they faced conditions with which they were totally unfamiliar. Total or partial failures have generally resulted not through lack of application, but rather from misdirected effort. These weaknesses and failures can nearly all be avoided by competent guidance and control of settlement.

The homestead regulations were framed for the settlement of the prairie lands and do not meet the requirements of the present available Crown lands. The areas of open land suitable for homesteading have already largely passed from the Crown, but there are still large areas of unsettled Crown lands with soil suitable for settlement. These, however, require considerable improvement in clearing, drainage, road construction, etc., before they should be made available for settlement. In their present condition it is not to be expected that the average settler with limited capital, unaided, can successfully make a living on this land while in the process of development.

Under our present regulations, grants, consisting of fixed areas, control the initial farm units The granting of farm allotments in any part of Canada, should not be on a fixed acreage basis, but rather on an economic basis. The size of the farm unit should be controlled by its ultimate use such as ranching, grain growing, mixed farming, etc. The chief factors determining its use are soil and surface characteristics, climate conditions, etc. As our lands present a wide range of these conditions a scheme of land classification is essential. This would necessarily be more intensive than the classification separating agricultural from non-agricultural lands. The success of any settlement scheme must be founded on a careful classification of the lands affected.

A great deal of information acquired by the various government services dealing with the land has never been made available to the settler. At present it exists in the files and records of these various branches. From this source alone much information invaluable to the settler may be obtained and could best be co-ordinated by a controlling board.

There should be the fullest co-operation between the various provinces and the Dominion in placing the settler on the land. The settler should not be allowed ot settle upon land where the conditions are so different from those under which he formerly worked that he has little chance of success. He should be directed to those districts most favourable to his past experience, irrespective of provinces. To do this requires an intimate knowledge of the settler, careful land classification and the fullest co-operation with the various provinces. There should also be, as far as possible, a co-ordination of settlement regulations and requirements throughout the Dominion. Several of the provinces have already established some system of rural credits to assist settlers. The provincial activities in aid of settlement should be definitely linked up with a federal land settlement policy, which can be accomplished to the greatest advantage of all concerned by a federal land settlement board co-ordinating all land settlement.

It is recognized in banks, and by mortgage, loan and investment companies that a farm in operation is one of the most desirable forms of financial security. In the case of a loan by the government to a settler it is an even more substantial security in that every new settler permanently established constitutes a new source of either direct or indirect taxation. Many competent men would seek the land if their financial condition permitted. This is particularly true of many farmers' sons and farm labourers. The great outlay necessary to become securely established on a farm requires more than they are able to command. These men are very desirable settlers and should be assisted by the government, but all such assistance should become a first charge against the land. Such loans whether in the form of government development work or assistance in building and equipment should be made only to those who have sufficient capital to make a substantial financial investment in the enterprise as a guarantee of good faith. This has been well established by similar settlement schemes in other countries such as Australia, New Zealand and California.

It has been proved beyond doubt by the experience of similar boards in other countries that the field problems of land settlement in the initial stages, have been carried on most successfully when viewed as an engineering problem and entrusted to men with engineering training rather than to men familiar only with agricultural and administrative work. A land settlement board would be very much strengthened by including an engineer familiar with the problem of land development and capable of utilizing and co-ordinating the services of the various engineering staffs already established in the government service to deal with the different land development problems.

Summary.

So far we have touched on a few of the problems of land development. The following is a brief summary:—

1. Development of our natural resources is urgent in view of the financial situation of the country.

2. Land settlement is recommended as one of the best means of improving the situation by:—

   a. Increasing the producing population and thereby decreasing the per capita debt.

   b. Increasing production and stimulating trade.

   c. Improving the railway situation by increased freight.

3. An active but discriminating immigration policy must be carried on.

4. Rapid development in new areas is essential to success.

5. Settlement needs a directing force.

6. Weakness of our present system and urgent need of control to correct that weakness.

7. The present homestead regulations are not suitable for available Crown lands.

8. Development work necessary before settlement.

9. All information available can best be c-ordinated by a board.

10. Farm unit should not be fixed acreage, but an economic unit. Land classification necessary.

11. Provincial co-operation essential for complete success.

12. Rural credits to settlers an essential part of the settlement.

13. Engineer necessary on Settlemnt Board.

Practically all the machinery necessary to handle land settlement already exists in the various organizations shown on the attached chart, but coordination, which is essential, can only be obtained by an independent organization which would receive its information and assistance from all these organizations and if supplied with the necessary power, would put settlement on a sound basis.

In view of the probability of a large immigration in the next few years the need of an increased rural population, and the large areas of unsettled land still existing in the Dominion, we would, therefore, from our first hand knowledge of settlement conditions which obtain, most strongly urge the adoption of a constructive federal land settlement policy and the establishment of a representative land settlement Board to form the connecting link between the settler and the land.

LAND SETTLEMENT BOARD

The Link Between Settler and Land.

Settler

Department of Agriculture.

Transmits scientific agricultural information and arranges courses of ininstruction.

Provincial Government Offices.

Deals with agricultural roads, drainage, education, telephones, community centres, health, etc.

Western Canada Colonization Association.

Conducting a general campaign to get settlers for idle patented land.

Soldier Settlement Board.

Has a great deal of useful information and experience obtained in the settlement of returned soldiers.

Department of Immigration and Colonization.

Carries on work in foreign countries in acquiring the proper kind of settlers.

Department of the Interior—Natural Resources.

Publishes maps and reports on natural resources.

Reclamation.

Prepares land for settlement by drainage and irrigation.

Topographical Surveys.

Surveys new lands, classifies land as to the suitability for settlement, clears land by controlled fires, etc.

Dominion Lands

Provides statistical information dealing with the land.

Land Settlement Board Land.

Land

MR. CUMMING suggested that some member of the Association be requested to get in touch with the Western Canada Colonization Association in connection with matters affecting land settlement. Mr. Hawkins expressed the view that it was outside the province of this Association to offer to assist immigration in this way, and that the Western Canada Colonization was simply a financial proposition. Mr. Akins supported Mr. Cumming's suggestion, pointing out that the Western Canada Colonization Association had been organized by Mayor Brown of Medicine Hat and that it was a patriotic organization and not out to make a profit for private interests.

It was moved by Mr. Cumming, seconded by Mr. Macdonald, that it be an instruction to the incoming Council to take up the matter of land settlement with the Western Canada Colonization Association. Mr. Herriot supported the motion. Mr. Henderson agreed with a suggestion made by Mr. Peters that if the motion were so worded as to instruct Council to consider the advisability of taking the matter up with the Western Canada Colonization Association, it could do no harm, and said that if at the end of a few months it was found that the aims and objects of that organization were harmful, the D .L. S. Association could act accordingly. The motion was finally amended to read :

> That it be an instruction to the incoming Council to consider taking up the matter of land settlement with the Western Canada Colonization Association. Carried.

After some discussion on the subject of a Land Settlement policy, Mr. Peters suggested that the meeting might express its opinion on the question whether the subject might be given publicity, and it could be decided later what avenue should be used for this purpose.

Accordingly, it was moved by Mr. Henderson, seconded by Mr. Shaver:

> That in the opinion of this meeting there is no objection to any individual giving publicity to the contents or the substance of the report presented by the Land Settlement Committee. Carried.

Mr. BLANCHET presented the Report of the Historical and Biographical Committee, and moved its adoption.

REPORT OF THE HISTORICAL AND BIOGRAPHICAL COMMITTEE

G. H. BLANCHET, CHAIRMAN.

Historical Report—

The preceding historical committee undertook an excellent work in beginning a compilation of the early history of the Canadian North-West as regards surveys and explorations. The period and area covered in the last report were so large that details could not be given but it was suggested that it should serve as a framework to be amplified by succeeding committees .

Acting on this suggestion the present report deals in some detail with certain of the early establishments some of which have developed into our present important western centres. Valuable assistance was given in this work by Mr. R. Douglas, M.A., Secretary of the Geographic Board, through whom we had access to the most reliable sources of information.

The particular interest to a surveyor in such a record lies in the fact that his work often brings him to localities possessing historical interest and if he is well informed on these matters he might have the opportunity of carrying out investigations which might have important results in establishing facts about these matters.

In making researches along these lines one is impressed by the fact that it is very difficult to obtain agreement as to dates and localities and therefore all new authentic information is especially valuable in settling questionable points. If the members of the Association made a practice of advising the acting committees through the Secretary of any such information so obtained, material would be accumulated which with the reports might at some future date be compiled and published not only with the weight of the Association behind it but that efforts be made to interest such organizations as the Historic Landmarks Association in making it a valuable addition to any reference library.

The establishments considered here were, for the country they served, the main receiving depots for furs and goods and divisional points in their transportation and several of them were so well located that they have retained their functions to the present day with the ordinary commodities of commerce substituted for the fur trade.

The Forks of Red River—Winnipeg Locality.

La Verendrye, proceeding westward from Montreal into the then unknown West, selected the point where Assiniboine river enters Red river as a suitable base from which to carry on operations into the country to the west and in 1738 he built Fort Rouge on the north side of Assiniboine river at the forks. Its exact location is in some doubt but it was fixed with some certainty by Alex Henry as on the north side of the Assiniboine when he arrived there in 1800. It was shown as an "ancient fort" on a map of 1750 and is not in Bougainville's list of forts in 1757. The locality is spoken of towards the end of the 18th century as "the forks" and the H. B. Co. had an establishment there known by that name in the early years of the 19th century. This is referred to in the diary of John McLeod of that company who notes that he wintered there 1814-15. Neither Thompson nor Henry note any establishment at this point 1798-1800.

In the summer of 1807 John McDonald of Garth built Fort Gibraltar at the mouth of Assiniboine river on the north side. In 1812 when Governor Miles McDonnell of the H. B. Co. arrived with Selkirk's colonists he built Fort Douglas, one mile below the site of Upper Ft. Garry. The rivalry of the companies was then at its height and the North Westers viewed the settlement with disfavour and put all possible obstacles in their way.

In 1815 Fort Gibraltar was seized for the H. B. Co. by Colin Robertson and in the following year it was torn down and its materials used to strengthen Fort Douglas. Fort Douglas capitulated to the N. W. Co. adherents after the affair at Seven Oaks when Governor Semple was killed in 1816. Lord Selkirk's arrival with his regiment of De Meurons re-established order in the colony and the publicity given to these events in England and Eastern Canada hastened the amalgamation of the two companies which was concluded in 1821. About this time a fort called Fort Garry was built about the site of Fort Gibraltaar, Garry being deputy Governor at the time. This was rebuilt on slightly higher ground in 1835-36.

Lower Fort Garry, located 19 miles down Red river, was commenced in 1831 and was for a time the residence of the governor of Ruperts Land and also the city government.

From the nucleus of Selkirk's Red river settlement has grown the city of Winnipeg.

The Forks of the Saskatchewan-Prince Albert Locality.

The strategic value of this locality was recognized from the earliest days but to no fort does the remark of Alex. Henry apply more than here that "The gentlemen of the N. W. Co. are so fond of shifting their buildings that a place is scarcely settled before it is thrown up and planted elsewhere."

The establishments that at different times have marked this district extend from Sturgeon fort at the mouth of Shell river to Finlay's House and Lower Neepawa at Nipawin rapids..

The more important of these are:

Sturgeon Fort at the mouth of Shell river noted by Henry in 1808 as unoccupied and "where there had been many establishments".

Fort Providence on an island not far below Prince Albert also abandoned and in ruins in 1808.

Fort St. Louis and later Fort a la Corne which is the historic locality here. It was first built as Ft. St. Louis by La Verendrye in 1751 and rebuilt two years later by his successor in the old French Co. Legardeur de St. Pierre, who renamed it Fort a la Corne. The location of this fort is given by Tyrrell as about the north east corner of the H. B. Co. Reserve and he noted that traces of the old trails and stockades were still to be seen in 1896. In 1755, when visited by Hendry of the H. B. Co. it was occupied by six men for the French Co. but in 1772 Cocking also of the H. B. Co. found it deserted except for an Indian camp. In 1776 Alex. Henry, the elder, arrived here and found a considerable establishment under James Finlay. About an acre of ground was enclosed by a stockade and 50 to 80 men were attached.

It was abandoned by the N. W. Co. in 1805 and the site was unoccupied till 1848, when the H. B. Co. rebuilt on the old location. In 1887, when in charge of Philip Turner, it was moved three miles up stream to its present location. While occupied by the N. W. Co. it appears to have gone under the name of Fort St. Louis, but the H. B. Co. revived the name of Fort a la Corne by which it is now known. It was sometimes called Upper Neepawa. This fort was one of the oldest and most continuously occupied of the establishments in the West.

In addition to the above there was one other location occupied in this vicinity at various times. This is shown on Franklin's map as at Nipawin rapids. Here he shows a site on each side of the river, that on the North side being called Finlay's House.

Carlton House.

Carlton House cannot be considered one of the major establishments of the days of the fur trade nor has it developed into an important centre of to-day but it has interest and importance in the constant reference made to it by the early travellers and in its position on the trade routes.

It was founded probably about 1797, or it may have been a year or two earlier. The N. W. Co. establishment here went by the name of the Montee or crossing place referring to the fact that here canoes were exchanged for horses if going north to Green lake and Beaver river or south to South Saskatchewan at Batoche. Franklin's map of 1819 shows Carlton House at its present location and the N. W. Co. House about three miles up stream on the opposite (north) side of Saskatchewan river.

Sir George Simpson notes of Carlton house that it was one of three principal meat depots, the others being Edmonton and Fort Garry. It is probable that it owed its importance and maintenance to this fact.

For a time Carlton House was an important transportation centre in the days of the Red river cart. Goods for the north were brought here from Winnipeg and forwarded to Green lake and thence by water routes north and west, and the fur was brought out by the same route.

Edmonton Locality.

The first establishment in this district was Fort Augustus, built by Shaw and McGillivray in 1794. It was on the north bank of Saskatchewan, a little more than a mile above the mouth of Sturgeon creek. The following year George Sutherland built beside them for the Hudson's Bay Co. To the latter post the name Fort Edmonton was applied in compliment to his clerk, John Prudens, a native of Edmonton, near London. The Indians of this locality belonged to the Blackfoot, Peigan and Fall tribes and were controlled even at the forts with difficulty. These two forts formed the most westerly trading station till 1799, when Rocky Mountain House was built 200 miles farther upstream.

In 1807 they were destroyed by the Indians and abandoned. Some phases of life among these Indians is suggsted by Thompson's account of this affair. In his note book on September 25th, 1807, he records: "About 2 or 3 months ago the brother of Old White Swan, a Blackfoot Chief, had with his band, a party of Blood Indians and a few Fall Indians, pillaged Fort Augustus and left the men without even clothing on their backs. They possessed themselves of many guns, ammunition, tobacco and many other articles and finding themselves thus rich they were gone to war with the Crow Mountain Indians."

New Fort Augustus was built by a trader named Huges of the Northwest Co. in 1808, and Edmonton by Rowand of the H. B. Co. in the same year. Both were abandoned in 1810, and were re-established at Whitemud Creek. It is not known when Fort Edmonton was reoccupied but it is known to have been occupied in 1819.

The establishment at the present city of Edmonton was first on the flats and later it was moved to the top of the hill where it now stands, near the Parliament buildings. Till recent times its defences had to be maintained on account of the troublesome nature of the Indians.

Other establishments of this locality were Fort George, near the Frog lake Indian Reserve and situated in the northeast corner of section 24-56-6-4; Fort Vermilion in section 14-54-3-4 and Fort Pitt.

Reference was often made to the Edmonton post as Fort des Prairie.

Cumberland House.

No establishment was located here by the old French Co., although they maintained a post for many years called Fort Basquia situated about the present locality of the Pas. This was built in 1750 and was noted by Hendry five years later stating that many of the more valuable light furs were disposed of here by the Indians travelling to Hudson bay. His report of conditions inland made to the officers of the H. B. Co. at Fort York on his return was not credited and he left the service in disgust exclaiming "they do not wish to be told what they do not know."

Alex. Henry in 1808 found the remains of an old fort which he estimated to be 50 years old at the locality of Fort Basquia.

The first settlement on Cumberland lake (then known as Pine Island lake) was made by Frobisher in 1772. He found he could conveniently intercept the Indians bringing their fur to Hudson bay to the H. B. Co. So serious did this leakage become that the H. B. Co. were forced to change the policy heretofore pursued of making the Indian come to them to trade and henceforth to an ever increasing degree they extended their posts inland following the lead of their aggressive rivals, the Montreal traders, later the N. W. Co. In 1774 Samuel Hearne built a fort at Cumberland lake at the east end which marked the beginning of a struggle for supremacy in the fur trade which was marked by ever increasing bitterness often accompanied by lawlessness. This was only terminated by the union of the two companies in 1821.

The early locations are noted by Thompson in his journal of 1793 when he was going west. At Gull lake portage he writes "the new settlement is ¼ mile S. 79 E. and then one mile S. 64 E. to the old house." Franklin's map of 1819 shows the two posts close together one on either side of this portage where it leaves Cumberland lake. The position given by Thompson lat. 53° 56′ ¾, long. 102° 13′ checks as nearly as may be determined with the position of the present settlement.

The name "Cumberland" was first applied by Hearne in honor of Prince Rupert, Duke of Cumberland, the first Governor of the H. B. Co.

From Cumberland House two routes open into the interior: west and south, Saskatchewan river and its branches reach the fur country of the far west and the hides and meat from the buffalo of the plains; northwest and north water routes gave access to the upper Churchill country and into the Mackenzie basin.

York Fort—Nelson River Locality.

The possession of the establishments at the mouth of Nelson and Hayes rivers in the early days of keen rivalry between the French and English over the ownership of the Hudson bay territory was considered the key to the situation. On account of their importance these forts changed hands many times and were often destroyed. In rebuilding them their locations were often somewhat changed.

The mouth of Nelson river was first reached by Button in 1612. He wintered there at the mouth of Root creek, of the present map, which he named Port Nelson after his sailing master. His ship was lost during the winter. Button set up a cross here, taking possession of the country for the British Sovereign and named it New Wales, he himself being a Welshman.

In 1631 Fox entered Hudson bay seeking a passage to the Orient and carrying letters for the Emperor of Japan. He spent 14 days at Port Nelson, taking harborage in what is now known as Hart's creek. He found and restored Button's cross and replaced the decaying wooden notice of possession by one of lead.

In 1670 goods were landed here by the H. B. Co. but when the river was reached four years later by Governor Bayly he noted that there was no fort. The year 1682 saw the first settlement here and not by one but by three companies. The first to arrive were probably Radisson and Groseilliers with two small ships from Canada. They established themselves at some distance (about 15 miles) up Hayes river on the east bank. Next came Gillam, Jr., representing New England interests and about the same time Gillam Sr. with Governor Bridgar of the H. B. Co. The former located on Gillam island and the latter at Woodchuck creek up Nelson river. During the winter Radisson by a masterly use of craft and diplomacay gained complete possession of the situation and sent his rivals away in the spring. Radisson applied the name Bourbon to his establishment on Hayes river (above the present York Factory and on the opposite side of the river) in 1683 but the following year Nelson river was referred to as Bourbon and Hayes as Ste. Therese and it is probable that the H. B. Co. font at Woodchuck creek was occupied and called Fort Bourbon.

With Radisson's return to the services of the Hudson's Bay Co. in 1684 Fort York was recovered by the Company. In 1691 an expedition from Canada under Troyes and d'Iberville established themselves in the Bay. They captured the southern posts but when they appeared before York, Governor Phipps burned the fort rather than surrender. It was rebuilt by the French as Fort Bourbon and was retained by them till 1713, when it was returned to the English by the Treaty of Utrecht. In 1782 York was captured by the French and burned but was rebuilt the following year by the H. B. Co. In 1788 so much damage was caused by floods that it was moved about half a mile upstream to its present location, the operation occupying five years.

A map of about 1746 shows "York Fort" on the same side of the river as at present and a little down stream. This is probably the fort as handed back by the Treaty of Utrecht.

The present site dating back to 1793 and that half a mile down stream may be accepted as the locations of chief historic interest, while the other points occupied here and at the mouth of Nelson river connect the locality with the history of the district.

The Mouth of Churchill River.

This is the only harbour on the west coast of Hudson bay which may be entered at all stages of the tide. Reference was made to it by Fox in 1631, but on a map of 1662 it is shown as Grigg's bay and no river is indicated. Reference was made to it as Churchill in 1688, the name being derived from Lord Churchill, (Marlborough). This locality did not assume importance in the first period of development at Hudson bay and it was not till 1688 that a move was made towards a settlement here. In this year Kelsey of the H. B. Co. was sent from York to find a site for a fort near the mouth of the river, and a trading post was established about five miles up from the mouth.

In 1718 a wooden fort was built inside the mouth of Churchill river but so great had been the losses sustained by the Company during its early years from the capture and destruction of its wooden forts that it was later decided to supply an adequate defence to this, its principal harbour on the bay, and in 1734 construction was begun of the remarkable stone fort on Esquimaux point at the north side of the mouth of the river. The material of the old wooden fort up the river was used in its construction and the stone fort received the same name as the earlier one. Here on this bleak and barren shore was reared a structure rivalled on the continent only by Quebec for natural advantages and massive strength. It was situated on a low sandy point difficult to approach by land and protected from the sea by extensive shoals.

The walls from 37 to 42 feet thick at the base and 6′3″ wide at the top. The parapets were originally of wood but this was later replaced by stone. There were forty embrasures for guns.

Hearne made his start from Fort Prince of Wales on his overland trip to Coppermine river in 1769. In spite of the perseverance and courage shown by him on this trip he later in 1782 surrendered Fort Prince of Wales to the French under Admiral la Perouse without firing a shot. They destroyed the fort as far as possible and some of the guns were taken away. It remains to the present day in much the same condition to which it was then reduced.

The masonry is almost intact though some of the archways are beginning to crumble, and the cannon lie rusting on the ground overgrown by shrubbery.

Thus we find that this fort which was a triumph for military engineering considering its period and locality stood less than fifty years and capitulated the first time it was attacked. No attempt was ever made to restore it.

When Thompson arrived here in 1784 he found a newly constructed establishment on the site now occupied, a few miles upstream from the old fort.

Churchill river was used as a trade route by the H. B. Co. from 1792 till the union of the two companies in 1821. This was considered expedient on account of the unsetttled condition of the more southerly route due to the rivalry of the traders.

The Churchill locality presents interest in its natural harbour and also largely on account of the ruins of the stone fort. The present establishment is either at or near the site of the original fort located here in 1688 and rebuilt in 1783.

Establishments on James bay connecting it with the early history of the country are Severn House, Albany House, Moose Factory (Fort St. Louis of the French) and Fort King Charles at the mouth of Rupert's river holds interest in being the first fort built on Hudson or James bay—in 1668 by

Radisson and Groseilliers representing the London merchants who two years later united to form the Hudson Bay Co. Moose Factory locality was first settled by the French from Canada under Father Albanel about 1669.

These stations suffered many changes of ownership and were often destroyed.

Norway House.

Norway House was originally situated at the north end of lake Winnipeg at the entrance to Playgreen lake near Mossy point. It was noted here in 1819 by Franklin who gives its origin as a settlement of Norwegians who were driven from Selkirk's Red River settlement by the commotions arising from the rivalry of the two companies there about 1815. Franklin also shows another Fort—Jackhouse at the point where Jack (now McLaughlin river) enters. Ermatinger in 1827 notes the establishment on Mossy point and a new one 25 miles down Jack river. The reason for the change is given by Sir George Back in passing this point in 1833 as due to the encroachment of the Nelson on the original location, the encroachment being 300 yards since 1819. To-day the original site is grass grown, and is marked only by remains of the foundation. The present establishment is on the north end of a small island near the entrance to little Playgreen lake.

In the early days of the last century, while goods were still being transported from Hudson bay into the interior as a divisional point Norway House had importance due to its position with respect to the waterways from the south and west. For a time it had the honour of being the meeting place for the annual Northern Council of the Hudson's Bay Co. which had jurisdiction from the Bay to the mountain and from the International Boundary to the Arctic. Sir George Simpson presided at 17 meetings here. The volume of trade passing through this route at that time is indicated in a note by Hargrave in 1858 which states that 167 freight boats of the large class belonging to the Company called here.

Another point of interest attached to this establishment is due to the fact that here the Rev. James Evans (1801-46) invented his Cree syllabic characters which was an important step towards civilizing the Indian. His service was recognized but not rewarded by Lord Dufferin when Governor General, who said '.the nation has given many a man a title and a resting place in Westminster Abbey who never did half so much for his fellow-creatures.''

At Norway House there is a leaden sun dial that was set up by Sir John Franklin. The last meeting of the Hudson's Bay Co. in which the transfer of its lands to the Dominion Government was arranged was held here.. It was presided over by Donald Smith, then Governor at Fort Garry. In the days of the transport Norway House was the first point inland from Hudson bay at which pemmican was obtainable and was appreciated for this reason by the boatmen.

MR. W. M. DENNIS.—We are all agreed as to the loss we have sustained in the death of Mr. Fawcett; and I would like to move that a memorial—the preparation of which should, perhaps, be directed by the President of the Association—be sent to Mrs. Fawcett and also to Dr. Otto Klotz, expressing our sympathy with them in the great losses which they have sustained.

MR. HERRIOT: There is nothing I can add to what Mr. Dennis has said. I wish to second the motion. Carried unanimously.

REPORT OF TOPOGRAPHICAL SURVEYS COMMITTEE.

On behlf of the Topographical Surveys Committee Mr. W. J. Boulton, D.L.S. gave a very comprehensive description of the work being done by the Topographical Surveys Branch in revising the topography of the Sectional Maps of the Western provinces.

CANADIAN INSTITUTE OF SURVEYORS.

THE CHAIRMAN: This concludes the reports of standing committees. There was a committee authorized at our last annual meeting in connection with the formation of a Canadian Institute of Land Surveyors. Mr. Hawkins is convenor of that committee.

MR. HAWKINS: I have very little to report with regard to this matter. We had some correspondence during the season with different surveyors throughout the Dominion, and although we received some replies to our letters we did not get very far. However, the matter is still being considered. I think we should not drop it; we should either appoint another committee or allow this same committee to continue its work.

THE CHAIRMAN: If the meeting approves the continuance of the committee I do not think that any particular action is necessary to that end.

Late in the year it was brought to the attention of the Executive that certain legislation was proposed respecting the engineers of Ontario, and a committee was named by the Council to look after the interests of Dominion land surveyors. I think Mr. Akins was Chairman of that committee.

MR. AKINS: That committee was appointed not by the Association but by Council, and it is really not necessary to report at the annual meeting. However, if the meeting wants to know what was done, I shall be glad to give some information on that point. The committee was composed of Mr. Rennie, Mr. Herriot and myself. When we examined the proposed Bill, it was felt that the Branch of engineering which we call surveying was not recognized as engineering at all. The idea prevails among quite a number of engineers that surveying is not a branch of engineering. The committee, however, consider that it is, and there are many other engineers who are not surveyors who look at the matter in the same light. So we drafted a letter which we sent to the Chairman of the Advisory Council Committee at Toronto. Mr. E. C. Smith, and a copy of which we forwarded to the Ottawa representative of the engineers, Mr. Challies.

A meeting was called as suggested by Mr. Challies. It was supposed to take place down at the Museum in Mr. Boyd's room, but there was some misunderstanding; only a few of the representatives turned up, and nothing was done. We then had another meeting, and, taking into consideration what Mr. Challies said regarding the necessity of getting the consent of the Ontario Land Surveyors we wrote the following letter to the Secretary of the Ontario Land Surveyors Association:

(Reads letter).

In answer to that letter we received from the Ontario representative on this Advisory Committee the following letter:

(Reads letter).

The committee have done nothing since. I suppose the idea is to find out what the Association thinks should be done further.

> It was moved by Mr. Hawkins, seconded by Mr. Cumming, that the appointment of the Committee be confirmed and that they continue their work.

Mr. Hawkins' motion was duly carried.

THE CHAIRMAN: The next item of business is the election of a representative to the Ontario Associatioo. The meeting is open for nomination.

Accordingly, Messss. Pierce, Seibert, Hawkins, Akins, Narraway and Harriot were nominated. Messrs. Pierce, Seibert, Hawkins, Akins and Herriot asked permission to withdraw, and Mr. Narraway was declared elected.

MR. HERRIOT: I move that our secretary be instructed to communicate with Mr. Sykes expressing the thanks of the Association for the use of this room during our Fourteenth Annual Meeting. I would include also a direction that Mr. Turnbull be thanked for the use of the films at last night's smoker, and that the Association express its appreciation of the contribution made to our entertainment by the quartet. The Association should also express its thanks to Mr. Camsell, Dr. Shutt and Mr. Leavitt.

The motion was seconded by Mr. Pierce and carried unanimously.

MR. HAWKINS moved, seconded by Mr. Blanchet:

> That the secretary be instructed to write the Ontario Association expressing the appreciation of the Association of Dominion Land Surveyors of Mr. Spight's presence at this meeting as a representative of the Ontario Association, and the pleasure of having him as their guest during this annual meeting. Carried unanimously.

Amendments to Constitution and By-Laws.

THE CHAIRMAN; We will now take up the proposed amendments to the constitution and by-laws. These may be amended in any manner pertinent to the original amendments by a majority vote of the annual general meeting, and if so amended shall be voted upon by letter ballot as amended by the general meeting; if not so amended, they shall be voted upon by letter ballot as submitted.

The proposed amendment to the constitution is as follows:

> Arthicle 3. Amend to read: "The object of the Association shall be the promotion of the general interests and elevation of the standard of the surveying branch of the engineering profession."

MR. SEIBERT took some objection to the proposed amendment, suggesting that it might be better to ascertain definitely the attitude of the engineering profession before taking action of this kind.

Some discussion ensued, but no amendments were offered and the proposed amendment was allowed to stand as printed.

The proposed amendments to the by-laws were read by the Chairman in the order in which they appeared on the printed sheet distributed among the members.

"No. 2." No amendments.
"No. 11." No amendments.
"No. 14." No amendments.
"No. 23." No amendments.
"No. 24." No amendments.
"No. 27. Amend by substituting for line 2 the following: "Active members residing at Ottawa, five dollars; not residing at Ottawa, three dollars."

MR. KITTO moved that the proposed amendment read: "Active members, four dollars", but the motion was lost on division and the amendment allowed to stand as printed.

"No. 30." No amendments.
"No. 31." No amendments.
"No. 39." No amendments.

The meeting adjourned for luncheon.

FRIDAY AFTERNOON SESSION.

The meeting resumed at 2 p. m., the President, Mr. Seibert, presiding.

The CHAIRMAN asked for suggestions from the meeting as to the raising of funds for the ensuing year.

MR. HAWKINS suggested that papers presented at the meetings should not be more than two and one-half pages in length, and that the amount of material in the annual report be cut down. Mr. Herriot thought that the paper prepared by Mr. Johnson and read during this meeting should not be published in the proceedings, as it had already been published by the Alberta Land Surveyors. Mr. Peters suggested that increased advertising might be obtained for the annual report.

MR. BLANCHET: To get an expression on the matter, I move that the incoming Council be instructed to make what arrangements are necessary to get the report out as usual this year.

MR. PETERS: Would you take out those words "as usual"? That might tie the Council down to a voluminous report again. I second the motion with that little change.

Carried.

MR. HOTCHKISS: I think the reason why there was such a small vote on that question was that some members wanted it put a little differently. We would like to see something on record which would be an instruction to the incoming Executive to curtail the report, if possible; to cut it down, and to take steps to see whether further advertising cannot be obtained.

MR. McCLOSKEY: I second the motion.

The CHAIRMAN: Mr. Blanchet's motion did not cover that point. The usual procedure has been, of course, to curtail expenses as far as possible, but on account of the financial situation to-day, further curtailment appears to be necessary.

Carried.

MR. AKINS: Mr. Chairman, would it not be advisable at this stage to take the necessary action in the matter of giving our secretary something for the work he did last year? I refer, of course, to our retiring secretary.

The CHAIRMAN: You can do that after the other secretary takes the chair.

MR. AKINS: I think it should be done now. It is the old Council who should look after that.

MR. TEASDALE: Well, to settle the matter, I move that the usual honorarium be voted to our secretary for the past year.

The motion was seconded and carried unanimously.

Installation of Officers.

> At this stage the retiring President, Mr. Seibert, requested the President elect, Mr. Blanchet, to assume the Chair and conduct the remainder of the business of the meeting. Accordingly, Mr. Blanchet took the Chair, amid applause.

The CHAIRMAN (Mr. Blanchet): We will call upon our new secretary to take his place at the table. (Applause.)

I wish to express my sincere appreciation of the honour you have done me in selecting me as your President. There is only one point that I wish to bring up just now. Under the present by-laws it is very difficult for an outside member—that is, a member not resident in Ottawa—or one who belongs to what might be called the minority group in Ottawa, such as the members of the Geodetic Branch,—to reach one of the highest offices. In this, as in everything else, you get what you give; if nothing is asked of them in the way of service to the Association, they will very soon lose interest. The suggestion I would like is in the form of a notice of motion to amend the by-laws, as follows:

> That section 7 be altered to read;
> Three Vice-Presidents, two to be elected from members resident in Ottawa, one of whom shall represent the minority group, and one non-resident member.

This notice of motion is signed by A. H. Hawkins, G. Cowper, E. Martindale, S. D. Fawcett and G. H. Blanchet.

The adoption of such an amendment to the by-laws would do away with another condition which now exists under which the Vice- President automatically drifts into the higher position, practically without contest.

If there is no further matter to be taken up, a motion to adjourn is in order.

MR. SEIBERT: Speech from the secretary.

MR. MACILQUHAM: Well, gentlemen, I do not know that you made a very wise choice of secretary, after having Mr. Henderson for so long. You know, Mr. Henderson has been an awfully good secretary, and unless I can steal a lot of help from him I do not know that things will go as well as you expect. However, I am going to try to impose on his good nature; and I shall do what I can to further the interests of the Association.

MR. HENDERSON: Mr. Chairman, allow me to thank the meeting for the very substantial way in which they have remembered me. I have held the position of secretary for three years and have devoted a good deal of time to the work, as anyone must do who wishes to do it justice. I should gladly have continued in the office but I do not think it is good for an Association to have one man get into a job and stay there. In spite of Mr. MacIlquham's modesty, I am sure that he is the right man for the place, and that when you come to remember him next year you will find that he has economized in many ways and that he has very efficiently performed the duties of his office. I wish him and the whole of the new Executive a very great measure of success throughout the year.. (Applause.)

MR. AKINS: I think that the meeting should express its appreciation of the very able manner in which our retiring President has conducted the general business of the Association, and also of the success which has characterized his efforts in the handling of this meeting. I move that a vote of thanks be extended to Mr. Seibert for the services that he has rendered the Association. (Applause).

THE CHAIRMAN: I can vouch for the fact that Mr. Seibert gave a great deal of time and attention to the business of the Association, to preparing material for the annual meeting; and so on, and I have great pleasure in extending to him the thanks of the meeting.

MR. SEIBERT: Mr. Chairman and Gentlemen, I thank you very much. The work has been a great pleasure to me; and if what I get out of it is equal to the pleasure I experienced in doing the work, I am sure that I shall have been very well rewarded.

MR. HENDERSON: There is another gentleman who should make a speech before we close; we hear from him once in a long while. I refer to the Vice-President. (Applause).

MR. HERIOT: Mr. President, although the duties of Vice-President are not exceptionally heavy, I assure you that I appreciate the honour which you have done me in electing me to that office. Eversince I have been connected with the Association my first thought has been for its welfare and progress, and I assure you that that thought will be uppermost in my mind at all times, whether in office or out of office.

This concluded the proceedings of the Fourteenth Annual Meeting.

BIOGRAPHY

During the past year the Association lost one of its most esteemed members, Thomas Fawcett, D.T.S. The following is a brief sketch of his career.

The late Mr. Fawcett, born in Yorkshire, England, 1848, was the son of Ann Wetherell and Adam Fawcett and came to Canada with his parents in the year 1857, settling near Brantford, Ontario.

Being of an enquiring and enterprising disposition, he sought an opportunity to visit our great New West and in 1872 joined the survey party of the late R. W. Hermon, D.L.S., spending the season assisting in surveys in Southern Manitoba.

His apprenticeship was spent with Mr. Hermon, and he received his commission as a Dominion Land Surveyor in 1876 as a Dominion Topographical Surveyor in 1877, and as an Ontario Land Surveyor in 1881.

Upon receiving his commission as a Dominion Land Surveyor he was employed by the Topographical Surveys Branch on various surveys in the rapidly developing West among which were several exploratory expeditions, base line and meridian surveys. Among the more important of his exploratory surveys may be mentioned that from Lake of the Woods to Cat Lake, by the English, Albany and Catlake rivers in 1885, and alone thg Athabaska, Nelson and Churchill Rivers in 1888.

Mr. Fawcett served as a lieutenant under Lieutenant Colonel Dennis in the North West Rebellion of 1885 and was slightly wounded at the battle of Batoche, and his commanding officer writes of him: "The particular characteristic of Mr. Fawcett was his reasonable and consistent attitude as a sincere Christian at all times, and his great popularity with all members of his expedition."

In the year 1890 he took up newspaper work, editing the Gravenhurst Banner and later the Niagara Falls Record—the first daily paper in that place.

In the year 1897 he was appointed Gold Commissioner to the Yukon Territory, then in the throes of a gold rush, and for the most strenuous and trying period of that exciting time he organized and carried out successfully the functions of a difficult and thankless position.

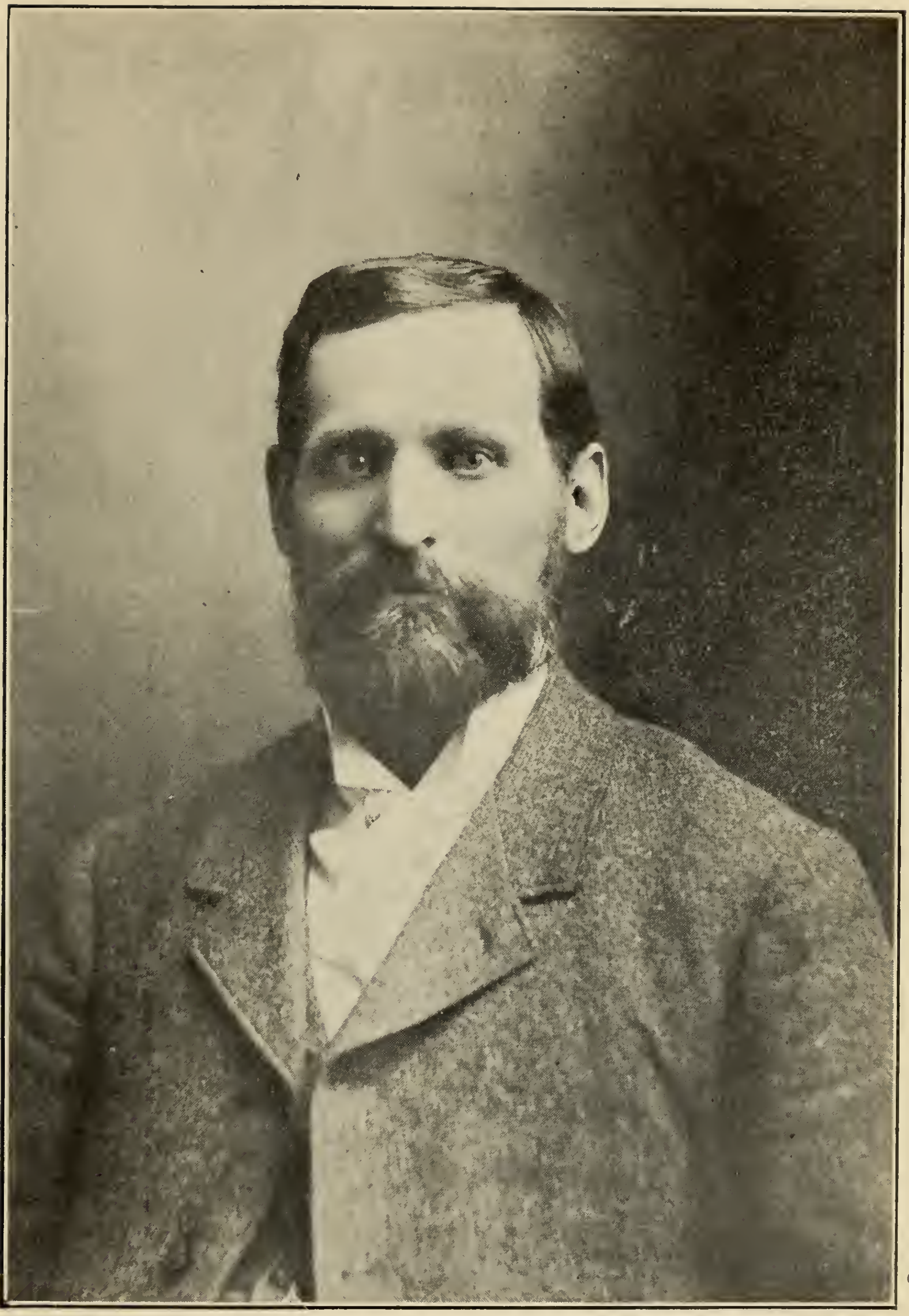
He returned to Ontario in 1899 and for several years was employed in the Topographical Surveys Branch. In the year 1910 he became a member of the staff of the International Boundary Commission, which position he held at the time of his death.

Mr. Fawcett was a valued member of several scientific societies in whose proceedings he always took an active interest. He was a past president of both the Dominion and Ontario Land Surveyors' Associations, an Associate member of the Town Planning Institute of Canada, a member of council of the Ottawa branch of the Royal Astronomical Society of Canada, a member of the Engineering Institute of Canada and a past president of the Geodetic Society and at the time of his death was a member of the Board of Examiners for Ontario Land Surveyors.

He was an Elder of Chalmers Presbyterian Church, Ottawa, when his call came. His record we are proud of, his example we may all with benefit try to emulate, and his achievements are a monument to his efficiency, honesty and excellence, to which Dominion Land Surveyors may at all times refer with pride.

He leaves to mourn his loss, his wife, four sons and three daughters and it may be said—

That those who knew him best
Loved him most.



THOS. FAWCETT, D.T.S.

ANNUAL REPORT

OF THE

Association of

Dominion Land Surveyors

TOGETHER WITH THE

Papers Read at the

Fifteenth Annual Meeting

HELD AT

OTTAWA

ON THE 1st AND 2nd FEBRUARY, 1922

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NOTICE TO MEMBERS.

The financial year closes Dec. 31 of each year. The current year's fees were due and payable Jan. 1. The Association cannot carry on without the necessary financial support.

To all those in arrears, the Council would urge that the annual dues be forwarded without delay.

Your Association is ever in need of papers of general interest to its members. Those who put forward an effort to prepare a paper find their efforts amply repaid in the pleasure they give to the general membership.

The Secretary will be glad to receive papers of interest from all who are willing to assist.

G. H. HERRIOT, B.Sc., D. & M.L.S., M.E.I.C., PRESIDENT
D.L.S ASSOCIATION, 1922.

ANNUAL MEETING, D. L. S. ASSOCIATION.

Held in the Royal Victoria Museum, February 1st and 2nd, inclusive.

The President, Mr. G. H. Blanchet, called upon the Secretary-Treasurer Mr. MacIlquham, to read the minutes of the last Annual Meeting.

Mr. MacIlquham stated that the Minutes were included in the last Annual Report, and it was moved by Mr. Fawcett, seconded by Mr. Gorman, that the minutes as contained in the printed report be adopted. Carried.

The Treasurer's report was then read.

REPORT OF THE SECRETARY-TREASURER.

Under the present constitution the Council consists of sixteen members in addition to the President, Vice President and Secretary. Highest attendance at any meeting was 10 and the average 6.5.

In accordance with the instructions of the annual general meeting February 1st, 1921, ballots for amendment to By-Laws as passed were sent out to the members.

The amendments to the Constitution and By Laws as recommended by the meeting were all adopted by the vote of the members.

The principal change was the increase in fees which was carried by a vote of 46-15.

Council meeting of April 1st. considered the question of printing the annual report. It was decided in view of the financial condition of the association to limit the expenditure to $300 this year.

In May, the secretary left for the field and Mr. J. B. Milliken was appointed secretary in his absence.

F. H. Kitto, Chairman of the Publication and Publicity Committee also left for the field about the end of May and Mr. Milliken found himself acting secretary and chairman of this committee.

Our annual report was printed and speaks for itself. The cost of $218.00 seems to me to reflect great credit on the business acumen of the Committee and the happy financial position of the club this year is due in a large measure to its energy and ability.

One hundred copies of a paper on Federal Land Settlement were sent out:

MEMBERSHIP.

On January 1st, 1921 the membership stood as follows:—

Honorary members	6
Active members	195

During the year the following changes took place:—

Members struck off for non-payment of fees				0
	Active	Associate	Junior	
New members	5	19	2	26
Resigned				2
Died.				0

On December 31st. the membership stood as follows:—

Honorary,	6
Active	171
Associate	19
Junior	2
Members still on roll but whose fees for 1921 have not been paid	29

REPORTS.

Five hundred copies of the annual report were received and disposed of as follows:—

Members	221
Complimentary	10
Advertisers	12
Ontario Land Surveys Association	150
Saskatchewan Land Surveyors Association	0
Alberta Land Surveyors Association	0
British Columbia Surveyors Association	0
Quebec Surveyors Association	0
On hand	70
Miscellaneous	37

One Hundred and fifty copies of the report of the O. L. S. association were received and distributed to members who are not members of the Ontario Land Surveyors.

FINANCIAL STATEMENT, JANUARY 1st. 1921 TO DECEMBER 31st, 1921

Balance from 1920	$ 33.94
Fees received	438.54
Advertisements	107.00
Sale of annual reports	6.75
Government grant	125.00
Interest	2.24

Premium on cheque	.45
Sale of tickets for luncheon	109.50
Sale of tickets for smoker	51.00
Total	$874.42

Expenditures.

Annual report, 1920	$ 30.02
Annual report, 1920	12.90
Collegiate Hall, 1920	20.00
Collegiate Hall, 1921	20.00
Adv't. in Electric cars, 1921	6.00
Tip to man at Chateau, 1920	4.00
Tip to man at Chateau, 1921	5.00
Honorarium Secretary to 1920	75.00
Rent for Library	7.50
Paid for smoker	52.00
Telegram to W. A. Begg	2.41
Telegram to W. L. MacIlquham	2.40
Paid for Chateau Luncheon	116.25
Reporter	80.00
Annual report printing	217.45
Typing	16.00
Stamps	3.63
Exchange	4.35
Advertisements	4.62
Express	1.95
Stationery	46.00
Total	$727.48
Total receipts	$874.42
Total expenditures	$727.48
Balance	$146.94

Assets.

Bank account Dec. 31st.	$146.94
Liabilities	0.00
Net balance	$146.94

W. L. MacIlquham,
Secretary Treasurer

Audited and found correct.
S. D. FAWCETT,
E. M. DENNIS.—Auditors.

Secretary-Treasurer,
Dominion Land Surveyors' Association,

Dear Sir:—We have audited and found correct the accounts of the Secretary-Treasurer for the year just closed.

The 1921 executive and the secretary and provisional secretary, Mr. Milliken, are to be greatly commended for the able and businesslike manner in which they have conducted the affairs of the Association during 1921.

When the executive took office the Association was faced with a deficit of about thirty dollars, and at the close of the year were able to show a surplus of about one hundred and fifty dollars.

For the guidance of future executives we believe it is well to point out that this 1921 executive achieved this remarkable success because they followed a wise policy, which was, "Keep our expenditures below our estimated receipts which should be conservatively estimated." It is possible that if other councils had followed this policy there would not have been any need for the increase in the annual fee.

E. M. DENNIS,
S. D. FAWCETT, Auditors.

MOVED by Mr. Stock, SECONDED by Mr. Palmer, that the Secretary's report be received as read. CARRIED.

President's Address.

Gentlemen:—There is nothing that impresses us with the passage of time more than an anniversary. When our attention is called to the fact that another year has passed, by such occasion as this, we unconsciously pause and consider the changes brought about in our associates and in our work. Looking backward we find that the last few years have brought great changes in both respects. The older generation of Dominion Land Surveyors whom it was our pleasure to meet each year have one by one dropped out of active practice or passed over the long trail. Even more marked has been the effect of this period on our work.

It is well for any organization to occasionally take stock of its position, to examine its past for its lessons and inspirations and to study the future in order that it may have a clear perception of its objectives and definite plans for attaining them.

Some fifty years ago Canada became conscious that the vast area lying between the Great Lakes and the Rocky mountains was not a wilderness unfit for habitation but contained much land suitable for cultivation and steps were taken to make these lands accessible and to develop them. One of the first matters to be considered was how they should be laid out. To solve this problem the organization to which we belong was called into being.

To the men who formed its nucleus—the executives and the field staffs—came a great opportunity and on their calibre and vision depended a structure the magnitude of which it was impossible to forecast. That it was met in a spirit worthy of the enterprise we all know. A high standard was set from the beginning and was maintained through the period when the value of the land was doubtful and later when its value was recognized by a tide of settlement that ever threatened to overrun the limits marked by the rapidly extended surveys.

Through this period of stress the members of the organization constantly meeting and overcoming difficulties and accepting hardships as a natural condition of their work, formed habits of action and thought which became the traditions of the profession. In this work, conceived and executed on a high scale, the work of the individual surveyor became a unit built up under working conditions such that in many ways it represented his own personality. If the work was good it fitted the structure; if poor, sooner or later it caused a local collapse. A general recognition of this responsibility developed an impersonal spirit of loyalty to the standards and ideals which became associated with the Commission of Dominion Land Surveyor and to a great extent became a controlling influence in his work. As the earlier Dominion Land Surveyors established the traditions and standards of the profession, these in their turn developed the men carrying on the work. The accepted idea of service was an exacting one. The surveyor would receive instructions to perform a certain work the difficulties of which were often almost unknown. He would proceed to carry this out, basing his plans on the past experiences of himself and others, and more or less completely cut off from all the machinery of civilization and living under conditions of the most primitive nature, he had the responsibility of the safety, health and conduct of his party resting solely upon him for many months. During this period the advantages and refinements incident to the life of his contemporaries of home and the university were denied him and if he lived up to his traditions he had to accept conditions of living and of labor that even he himself wonders at in retrospect, till his purpose, the successful completion of his work, was accomplished. The idea that I would develop here is, that about the commission of Dominion Land Surveyor has been built up a spirit of service which is to a certain extent altruistic. He has demanded more of himself than has been asked of him and without thought of recognition or reward.

Probably every Dominion Land Surveyor recognizing what the work asked of him and what it offered both materially and as a life work has asked himself if it was worth the effort and the sacrifices. His answer is written into the records of the service. In general it might be said that if the work is not to a certain extent its own reward there are other callings in which the expenditure of energy and ability, required of a Dominion Land Surveyor, would produce more material results.

Through the period of pioneering and early development of the West the activities of the surveyor were concentrated on the extension of the survey system in preparation for the following tide of settlement. From the uniform nature of his work a fairly definite type of surveyor was produced. Stress was laid on those qualities which distinguish the pioneer rather than the engineer but his responsibilities were such that he was continually faced by situations which demanded clear-cut decisions on which the success of the work or the safety of the party depended. The best type of surveyor developed by these conditions was a man trained to be self-reliant and resourceful in meeting difficulties, undeterred by their magnitude, and actuated by a high sense of duty. He was to a large extent isolated from the questions of the day and the ordinary community life, and his problems, while requiring a technical understanding were largely practical.

With the progress of his work the boundaries of the wilderness receded and the fertile belt assumed more definite shape as the lines of the system were projected beyond the prairie and park country and into the woodlands and swampy country of the north.

Finally it became apparent that the extension of subdivision had not only passed safely ahead of settlement but that it had reached country in which the conditions varied so greatly that it did not lend itself to the uniform treatment accorded to that to the south. Here exploration to determine its value must precede the survey which was only warranted to meet present requirements in those areas measuring up to a certain standard. At the same time the governing lines of the system had been extended far into the north fixing its geographic features in position and supplying points to which isolated surveys could be tied and from which new surveys could be projected. The other work carried on by the Dominion Land Surveyor, the extension of level nets, geodetic surveys, and private work offered only a limited field.

Our executives, our Association, and we as individuals had to face the situation squarely. Was the usefulness of the organization approaching an end? Was the limited field to which our activities had been restricted by the urgent call for land the only one for which we were fitted? Could no advantage be taken of our specialized training and knowledge in assisting with the problems of settlement, reconstruction and development with which the country is faced? The evidence of fifty years' efficient service should be sufficient to show that the organization not only deserved to survive but that it would be a distinct loss to the public service if allowed to disintegrate. The problem became one of directing the activities of the surveyor into the most useful channels and for he himself to adjust and broaden his ideas in interpreting his duties and especially to use his initiative in studying the problems he encountered.

He had reached a divide from which he could look back on his work of the past—the preparation of a vast wilderness for settlement. This settlement had taken place following the lines he had laid down for it. He could observe to what extent his judgment had been correct in estimating values and conidtions and also where weaknesses had been revealed. So rapidly had the settlement taken place that he was able to observe the conditions before and after and he had the opportunity to study causes underlying success and failure. It must be clear that the collective information of the members of our association on this, one of the basic problems affecting the prosperity of our country, should form a part of the foundation on which a policy of settlement should be built.

However, the information was fragmentary and lacked co-ordination and from the detachment with which the surveyor was accustomed to regard many of the realities of public life he did not at once realize his responsibilities or his opportunities in shaping and advocating a settlement policy based on his observations.

Various things occurred to direct his attention to his place under the altered conditions. It had become a habit to refer to our unlimited resources in land and to encourage a flow of settlement into the West without giving much thought to what was found there. When the question of settling the returned soldier on the land came to be considered it became expedient to consider exactly what we had to offer. This revealed the fact that our information regarding vacant lands was much too meagre and lacked definiteness. In the early days when the prairies were being laid out the country in large areas was of a fairly uniform character and being open was easy for the intending settler to examine. Due to these conditions and also the necessity for speed to keep up with the pressing demand for land, detailed information as to topography, soil, etc., was not so necessary and did not receive much attention. Later when the surveys were extended into the bush and swampy country the idea of speed was maintained by the contract system and the information gathered was incomplete and indefinite although here it became more necessary as the areas of uniformity were much smaller. Consequently when the situation as to vacant lands came to be considered it was found that a stock taking was necessary, and this opened up a field of investigation with the classification of land for its object.

The added interest in topographical maps due partly to their use during the war, the necessity for a base map for soil surveys, the requirements of loan and land companies, and also to a large extent to the general use of automobiles widening the circle of interest of individuals creating a demand for information as to roads and the topographical features of the country, suggested another field for the Dominion Land Surveyor.

With the development of a district, the increased value of the land and the necessity for costly public works make the accurate determination of position, horizontal and vertical, important and necessitate surveys to determine them.

Circumstances combine to direct the attention of Dominion Land Surveyors back over the country through which they had already worked with an altered view point and an altered objective. His work brought him more and more intimately in touch with community life and its problems.

For the future therefore while the qualities associated with the Dominion Land Surveyor continue to be essential if he is to maintain the standard of the commission, he must keep himself informed on the questions with which our public men are confronted with a view to assisting in their solution. He should broaden his view by study of methods adopted elsewhere so that his judgment and recommendations be sound and not experimental. He must have a fairly accurate knowledge of what conditions may be successfully met by scientific treatment and those on which such efforts would be fruitless. He should among other qualifications have that of a consulting economist on land questions. With his knowledge of actual conditions he should be able to assist in the more intelligent direction of settlement and early development whereby the raw material of the settler and the land be constructed into a sound community. We have all seen the results of lack of direction, settlers scattered through an undeveloped district pitting their individual efforts against the hopeless task of making a living under these conditions. We have also seen the results of directed effort in settling selected localities such as the Porcupine reserve, and I think recognize the need for a broad policy of settlement whereby our resources are studied, our settlers carefully selected and under suitable supervision there be a reasonable chance of both becoming assets as soon as possible.

The fields of activity suggested here are not restricted but extend for Canada far into the future. The nature of the service is one of the most appealing—assisting in the construction of our national structure. The usefulness of the Dominion Land Surveyor on this work is limited largely by his own vission and initiative, and there is need for all our best thought in directing our efforts towards these ends.

Chas. Dana of the old New York Sun mentioned the following as the three essentials of the educated man:

The ability to observe accurately,

The ability to express himself clearly in terms which his hearers will understand.

The ability to obtain information rather than burden his mind with a mass of assorted knowledge.

These qualifications appear to be particularly applicable to surveyors and of the three that of expression is the one to which he gives least attention. This is a great weakness both in the loss of information which might be of value to the public and the loss to the individual in that a man is judged not by what he knows but by what he convinces others that he knows.

If a man confines his thoughts and study to those matters directly affecting his work he loses perspective in his outlook on life and his fellowmen and this in turn lessens his usefulness in his work for the problems one encounters contain many elements to the study of which one cannot bring too broad an understanding. It might be said that the evolution from the primitive to the intellectual man is from one with a small circle of interest of which the individual is the centre to one having an understanding of the relative insignificance of time, place and the individual in the scheme of things achieved by thought and study.

This brings us logically to the function of the Association. One of the most striking features of modern times is the tendency to organize. Members of all professions, trades and other activities are banding themselves together. Continually new ideas are brought forward about which a group is united. There are three main principles actuating these groups, first that of protection and strength in the community, second that of a more social and fraternal nature, and third that of public service, and it appears that in proportion to the prominence given by the group to the idea of service, that it be both broad and high, its ultimate standing in the community will be gauged.

Of the various organizations with which we are associated by our training and our work that of the Dominion Land Surveyors' Association, judged by the above standard, should have first claim. It should give protection in standing behind our commission which should be the foundation from which we should put forward any claim for rights and privileges. It is broad in embracing men from all parts of the country who are engaged in all the activities included under the commission and through its wide range its power for service and its field of influence are considerable.

However, it must be recognized that this power for usefulness both to its members and the public is a potential force which operates only in response to the spirit actuating it and if this power is not recognized by the individual members it functions only in an automatic way. The question is often asked with relation to various organizations "what benefit do I derive from my connection with it?" The answer can only be in the form of another question "what contribution do the individual members make to its service?" In our own case I should say that the most important use to which our Association may be put is that of exchange of ideas and expression. In the course of our work our members cover a large part of the country and have the opportunity to study at first hand many of the vital questions with which the country is faced. The railway problem is encountered everywhere with the uneconomic distribution of mileage causing a loss in operation here and a loss of production elsewhere. Closely allied with this question is that of settlement, again a question of distribution and the factors which control it. Year after year we meet men of all walks of life from the backwoods settler to the well-informed business man and have the opportunity of observing the many aspects of the problem. Ideas are formed which may or may not be practical but at least are based on actual observations of trained observers. If left to the individual it is probable that through discouragement they would be lost. Through the machinery provided by the Association with its committees and connections such suggestions may be studied along with others of a similar nature and put into practical form. If they be found acceptable they may be adopted as a policy and expressed through its various publicity channels till a favourable public opinion is created.

A disinterested expression of opinion on a public question by a body of trained men familiar with this question will undoubtedly be listened to and if the Association makes a practice of expressing itself its advice will be sought.

It has always been difficult for the Dominion Land Surveyor to give up his standpoint as an individual. His work has tended to develop this attitude, especially in the past. He had to depend on himself, to meet situations which continually arose and this while developing his self reliance produced a certain narrowness of spirit and a critical attitude rather than the broad tolerance necessary for community work. This has been less marked in recent years and the benefits to be derived from discussion of ideas with others thinking along the same lines is being more and more recognized. There is an old Chinese proverb which says "meet your brother face to face and your differences vanish."

It has often been remarked that it is difficult for an organization such as ours to obtain the public standing that is accorded to an association of doctors or of lawyers. The answer appears to be that the public appreciation of any body is proportional to the directness of their relations. When a man is sick he sees the doctor personally; when in business difficulties he applies directly to the lawyer; but with the engineer his relations are indirect and impersonal. In our own case our public is scattered and our only general appeal is on questions of policy such as settlement. Moreover the public appraisal of our Association will be proportional to the regard in which we ourselves hold it. We must be firmly convinced that it is good and performs a useful function before we can convince others of its strength and usefulness.

In conclusion I would sum up the purpose of these remarks as an attempt to show that the pioneering type of surveyor developed by the earlier work of exploring and surveying the western wilderness of the eighties reached a parting of the ways due to the advanced stage to which this work has been carried. After passing through a period of transition the Dominion Land Surveyor finds himself facing new conditions of thought and work the possibilities of which we only yet glimpse.

It is for us to apply to this task such a spirit of loyalty and service combined with thought and initiative that we may be as successful in assisting in the development of our country as those who preceded us were in the foundation work. I would only add that the opportunity for exchange of ideas and the expression of them afforded by our Association appears to be a power not fully appreciated and developed and to hope that in the future the Association achieves its purpose as the medium by which the strength, the fraternal spirit and the power for service of those who hold the Commission of Dominion Land Surveyor be maintained.

I wish to thank you for the honour you have done me in electing me to this position to which are attached both privileges and responsibilities. To the incoming executives I offer my sincere good wishes and hope that with the improved financial standing of the Association its activities may be stimulated and its usefulness increased.

The CHAIRMAN: We have with us to-day a representative of the Manitoba Association, Mr. J. L. Doupe, and also a representative of the Ontario Association, Mr. T. B. Speight. We welcome these delegates, and grant them the freedom of the meeting and hope they will take part in all discussion that may arise out of the reading of the papers and reports.

Mr. DOUPE: I have nothing to say, except to express my appreciation and pleasure to be with you today, and to extend the compliments of the Manitoba and Saskatchewan Associations.

Mr. SPEIGHT: I thank you on behalf of the Ontario Association for your kindly greeting and I have very pleasant recollections of your meeting last year and for that reason I was very anxious to come again this year. It was the intention this year of our President to be here and he would have been better able to represent the Association, especially as he is well able to make a speech. I am glad to be here and to see so many of the Dominion Land Surveyors present at the Annual Meeting. If it had been under the old regime when your members were not part of the Civil Service, we might expect that you were down here expecting an offer from the new government.

The CHAIRMAN: We will now have the reports of the different committees.

Topographical Surveys Committee.

Chairman,—Mr. A. L. Cumming. (Mr. Cumming was not present).

Mr. BLANCHET: I would suggest that Mr. Bolton's report of last year be included in this year's annual report.

REPORT OF TOPOGRAPHICAL SURVEYS COMMITTEE, DOMINION LAND SURVEYORS' ASSOCIATION, FEB. 4, 1921.

By W. J. Boulton, D.L.S., Chairman.

During the past few years while the departmental surveyors have been prosecuting their varied investigations in the three prairie provinces, they have had occasion in connection with their work to come in contact with representative men of industrial, commercial, and agricultural pursuits. When discussing maps, etc., it was evident that there was a great need for an up-to-date and reliable map showing information concerning roads, buildings, etc. It was readily apparent that such information compiled on the sectional sheets issued by the Topographical Surveys Branch, which in the past have shown only land boundaries, water areas, elevations at railway stations, etc., would meet with these requirements. It would also serve to show the advancement of the district to the interested investor from foreign countries. To meet this demand the Topographical Surveys Branch undertook the revision of sectional sheets during the season of 1919, and during the past season continued this work on a somewhat larger scale. Up to the present time the sheets fully revised are the following:—

Rosebud, Peace Hills, Edmonton, Calgary, Red Deer, Blackfoot,

Regina, Moose Jaw, Brandon, Dufferin, Emerson, Winnipeg, Saskatoon.

The stadia surveyors have, in connection with their regular stadia work, partially revised the following sheets:—

Virden, Souris, Moose Mountain, Qu'Appelle, Medicine Hat, Lethbridge.

By partial revision it is intended to mean, that the information concerning the roads, buildings and built up areas was obtained in detail. Barometric records, which will be taken up later in the report, were not obtained.

In connection with this revision work, it may be interesting to those who have not been intimately connected with it, to say a few words about the preparations made, the nature of the investigation, the methods employed in the field, and the subsequent reduction and compilation of the collected field data.

Information Preparatory to Commencement of Field Operations.

Township plans were used as a basis for the work. Information from the records of our Branch such as trail intersections, hill and valley crossings, and road diversions were shown on these plans. Furthermore, the limits of all water areas, as defined by recent surveyors were shown, irrespective of the class to which they had been assigned. Similarly the limits of former water areas as defined by older surveys and which are now possibly hay marshes or alkali flats, were shown. Such features as these invariably influence the surveyor in the allocation of contour lines and other features such as roads, buildings, etc. This information is further supplemented by a search through the records of the provincial offices, at which sources, one may find plans of all road diversions, and many times, considerable corrected interior sectional topography, e.g. creek courses.

Methods Employed in the Field.

Each of the revision parties was furnished with two Ford touring cars for investigation purposes, and in addition thereto was provided with either a standard Ford truck or converted truck for transportation. To each of these investigation cars was assigned the chief or his assistant, and a driver. The chief or assistant recorded the information on the township plan, being guided in his location of such by the speedometer register. Three barometers were read usually at the section and quarter-section corners, by one of the men, and the records made by the other.

Nature of Information Collected in the Field.

Data in connection with the following was obtained:—

(a) buildings
(b) streams
(c) railways
(d) soils
(e) telephone lines
(f) water areas
(g) wooded areas
(h) roads
(i) contours.

(a) Buildings.

The approximate location of the following structures was obtained:—Railway stations, post offices, churches, schools, elevators, country stores, gasoline stations (in rural parts), main farm buildings (i.e. houses), The limits and subdivision plan of all incorporated towns and villages, together with those of hamlets, if available, were obtained from the departments of municipal affairs, plotted on our township plans, and the buildings on these areas shown. Where numerous buildings existed in any one particular block, the block was shown as solidly built up. Isolated buildings in these areas were also recorded.

(b) Streams.

Information concerning the courses of small streams, hitherto unsurveyed since the manual did not require a survey for land areas, was obtained. Various methods, such as stadia, compass bearings and pacing, or sketching and pacing, were used, the method employed, depending upon the amount of time that the surveyor could allot to that particular area and that particular work. These small streams were placed in either one of the following classes viz:—perennial and intermittent.

(c) Railways.

Information as to whether railways were single or double tracked was recorded. The location of sidings was checked up.

(d) Soils.

While the surveyor was traversing the different parts of his district, he endeavoured, within the limits of time at his disposal, to make a general study of the soil. He subsequently took soil samples, the location of which, being so chosen, that their analysis would permit of an approximate delineation of the different soil boundaries.

(e) Telephone Lines.

To assist the traveller, the tourist, or in fact, any one not familiar with the survey system, in locating himself, the location of telephone lines was obtained.

(f) Water Areas.

Information as to whether water areas were dry or not, and whether they were fresh or alkaline, was secured. Furthermore information concerning the limits of water areas not previously shown on the plans, was obtained in a manner commensurate with their importance.

(g) Wooded Areas.

Sketching of wooded and scrub areas was done in a general way, so as to enable one to ascertain at a glance the portion more or less so covered.

(h) Roads.

The classification of roads was really the most important item in connection with this investigation. It was thought that the methods of classification, adopted by the Governments of Alberta, Saskatchewan and Manitoba introduced elements of futurity and uncertainty, and depended almost entirely on the means of financing and maintaining the roads.

The idea of our Branch was to prepare a map, showing roads classified according to their condition and utility for all sorts of travel during the present day. The opinion was that if we attempted to classify the roads according to the various provincial methods, use the adopted provincial nomenclatures, and at the same time give due and just consideration to condition, we would constantly run into difficulties and totally eliminate uniformity, particularly when you consider the various ways that the separate provincial governments classify what is intended to be the same standard of road. For the above reasons the following classification has been adopted.

Class (1)—Trunk roads, roads which are used as main thoroughfares, or for interurban purposes; the main arteries of through traffic—the Tourists' Road.

Class (2)—Secondary roads, roads serving large communities, and as a general rule connecting towns and villages—the Commercial Travellers' Road.

Class (3)—Well travelled roads, roads used for local traffic, and generally in good condition—the Farmers' Road.

Class (4)—Roads used for local traffic which are little travelled and usually in poor condition.

In summing up this classification it might occur to you that the surveyor is not taking condition into consideration as much with regard to classes (1) and (2) as he is with regard to classes (3) and (4), and therefore the classifications is not consistent. In this event, it may be explained that condition does not enter into classes (1) and (2), but possibly in an indirect way. It is obvious that mostly all class (1) and class (2) roads must be and are in good condition generally, since condition and utility go hand in hand. Furthermore they are usually improved highways, approved by the Provincial Highways departments, and maintained to a great extent by those departments and the municipalities. It is interesting to note, in this connection that after a surveyor has chosen his class (1) and class (2) roads, if a comparison is made with a map showing the provincial approved roads, that in ninety per cent. of cases, his location of these particular classes coincides with these approved highways. This bears out the contention previously mentioned, that condition enters into our classification of class (1) and class (2) roads. There are probably some isolated cases where a piece of class (3) road may be in a little better condition than some class (2) roads, but this is chiefly due to the fact that farmers in that particular locality are more concerned with the up-keep of their market roads than with the maintenance of through thoroughfares. Granting this, however, there is no reason to change its category. Its definition shows its condition and what more is necessary? Moreover class (1) and class (2) roads must have continuity, a requisite not at all necessary in the class (3) road.

(i) Contours.

Elevations from all reliable sources were obtained. The railway profiles of all constructed lines were secured, satisfactory equations established and the sea level datum elevations of road crossings determined. Elevations of the natural features and section and quarter-section corners along base lines and section lines previously levelled were obtained. All this information was either tabulated or placed on a copy of the sectional sheet for the convenience of the surveyor. Added to this the surveyors working in certain provinces were able to procure profiles of many of the highways. With this information as a basis of control, the revision surveyor while prosecuting his investigations connected with roads, buildings, water areas, etc., supplemented this level information, by recording barometric readings at section corners, and at other points which he deemed essential, in order to permit of a more approximate contour delineation than was possible with the previous information available. To further assist in contouring the surveyor sketched the hill features by means of form lines, generalized to suit the scale of the map and which serve to show the shape of the ground rather than its height at any point. The amount of sketching done, however, depended upon the amount of time that could be allotted to that particular phase of the work, which depended of course on the total area that was to be covered during the season. Ties were affected as often as possible at known elevations, so as to keep control within the limits. Repeat readings were also taken at various fixed points to further supply control. The variation of the atmospheric pressure was recorded by means of reading a barometer or barometers at camp hourly or half hourly during the day the interval elapsing depending upon the manner in which the barometer was acting. Where the control is good and after applying the correction for the daily gradient, it is remarkable how good the barometric results are. Even in the remote areas, where the control is somewhat scarce, the results are well within the error of the contour interval used on our map, viz. 50′, and which interval is much smaller than the conventional contour interval of maps of this scale, viz 150′.

Office Procedure.

In compiling this information, the sectional sheets are prepared by the office staff under the direction of Mr. Henderson, and the surveyed water areas, railway lines and creek crossings are inked in. They are handed to the surveyor at this stage, and he then compiles and inks in the information collected during the summer. Plans are made of the built up areas in the towns, cities and hamlets, and these are photographed down from thirty chains to an inch to two miles to an inch. These photographs are then placed in their proper position on the sectional sheet. A photograph is made of the sectional sheet and the lithographers make a number of prints in light blue. One of these prints is given to each of the draftsmen making the blue, black, green, red and brown sheets for reproduction. After the barometric reductions and adjustments have been made, the elevations are placed on the township plans. The contours are then drawn and transferred to a blue line copy of the sectional sheet. The draftsmen inks this in for reproduction.

REPORT OF LAND SETTLEMENT COMMITTEE

M. D. McCloskey, D.L.S., Chairman.

Your committee beg to report that during the past year the problem of land settlement has received considerable attention throughout the country in general and in some parts of the western provinces has become a vital question. The features outlined in the report of the Land Settlement Committee last year, especially the part advocating control of settlement would seem to have been well advised. In the public press and in circles connected with immigration and settlement policies, the subject has been brought forward with prominence. In the month of June a conference was held between representatives of the Dominion and Alberta governments which resulted in recommendations for agricultural and soil surveys in southern Alberta with a view to obtaining a reliable statement of the soil data and the introduction of measures ameliorating conditions in settled areas where farming has not been successful. In this respect the Alberta government has formed a committee, of which Mr. C. A. Magrath, D.T.S., is the chairman, for the purpose of conducting the necessary investigations. From the information obtained in our Land Classification surveys many instances are brought to the fore showing the necessity of a discriminate system of land settlement; a system along the lines of that embraced in the report of the Land Settlement Committee last year.

A short time ago the Deputy Minister of Immigration in his address, "Immigration and Citizenship", delivered before the members of the Ottawa Women's Club, emphasized the fact that Canada's great need today was for land cultivation, and told of a scheme being developed by the Department of Immigration whereby people anxious to go on the land shall be assisted. He stated: "The time has come that when we admit people into Canada we must treat them as an asset." These words are very significant and could aptly be applied in the far-reaching problem of land settlement.

Your committee had printed and distributed, about one hundred copies of a phamphlet entitled "Federal Land Settlement" which was based on the report of last year's committee. It is recommended to the incoming executive that the Land Settlement Committee shall continue its activity, as it is felt that the Dominion Land Surveyors should, if called upon, be in a position to readily furnish valuable information in connection with schemes dealing with settlement of our western lands.

Mr. NELLES: I would like to move the adoption of the report and in doing so would just like to say with regard to it, that I was reading in the "Veteran" last night, which is the official organ of the G.W.V.A., an editorial on employment. In the course of the article it praised very highly the land settlement scheme for returned soldiers and said that it was an unqualified success, but that it should not be confined to returned soldiers. The G.W.V.A. think that the land settlement scheme for soldiers should be open for every qualified man in Canada, returned or not, and men who are qualified, but who are without money, could be put on the land and thus relieve the congestion in the city. It is a very significant standpoint, that they think that men who did not go overseas should be allowed to take advantage of the soldiers' settlement scheme.

Mr. RANNIE: I second the motion that the report of the land settlement committee be accepted as read.

Mr. BLANCHET: It is not enough to put the people on the land, but you must also provide for that part of the year when the community as a whole is idle, especially in Western Canada. Not more than six months of the year is taken up with the work on the land. There must be other things to complete his year. This has been worked out very fully in Germany so that there is no time in the year that there is not some employment for different classes in each district.

REPORT OF THE COMMITTEE ON GEODESY.

W. M. Dennis, D.L.S., Chairman.

Geodesy, strictly speaking, is the science of reducing to the spheroid of reference, or the geoid, actual measurements taken on the earth. Many volumes of theory have been written on this subject and many men of outstanding ability have spent years applying this theory to practice and developing new theory and practical applications of such, as their experience was enlarged.

This report will have nothing to say on geodesy further than the mention of a few activities in this field and the suggestion to those interested that they study the reports and special publications of the United States Coast and Geodetic Survey, and the Geodetic Survey of Canada.

The Geodetic Survey of Canada is now carrying out an adjustment of the level net of Canada which will embrace all the precise levelling done in this country by the Geodetic and Topographical Surveys. This net extends from the Atlantic to the Pacific and from the most northerly lines of railways to points of the United States level net.

The datums on which this work is based are (1) in the east, mean sea level as given by the Atlantic Tidal stations at Halifax, Yarmouth and Father Point; (2) in the west, mean sea level, as given by the Pacific Tidal stations at Vancouver and Prince Rupert; and (3) the elevations above mean sea level of a number of points in the United States level net which after successive adjustments, the United States Coast and Geodetic Survey have fixed as "standard" for the time being.

The method of "conditions" is being used in the adjustment of this net. The procedure is in the nature of a differential, or progressive adjustment. The lines will first be adjusted, using only the Atlantic datum, and corrections called "d's" to the differences of elevations between junction points, obtained. The Pacific datum will then be introduced and corrections obtained to the values of the "d's" already found. Lastly, the American points will be brought in and second corrections to the "d's" obtained. The total correction to the difference of elevations between junction points will be the sum of all these corrections.

Columns are carried through for the determination of the precision of certain lines and circuits.

Weights are given all lines, based on length only.

In 1917, in Georgia and Florida, where the flatness of the country, and the prevalence of high timber made high scaffold signals necessary to give clear lines for triangulation, the United States Coast and Geodetic Survey began to develop a system for the establishment of geodetic control by means of precise traverse.

Their methods, at first largely experimental, have been improved till they now accept them as standard. Two classes of traverse have been developed, "precise traverse" having an accuracy it is claimed equal to that of primary triangulation, and "secondary traverse", comparable in accuracy with secondary triangulation. Detailed information and instructions for carrying out the field operations and adjustments may be found in special publication No. 58, of the United States Coast and Geodetic Survey, entitled "General Instructions for Precise and Secondary Traverse."

It will be seen that the system of using precise traverse, in conjunction with primary triangulation to supply geodetic control in some of the flat areas may be of considerable value to Canada. An initial move was made in this direction during the summer of 1921, when seventy-five miles of precise traverse was run with excellent results in the vicinity of Hamilton, Ontario, by our

Geodetic Survey. A judicious use of this system may effect considerable economy without lowering the general standard of work.

The experiments of Professor Michelson of Chicago University will be watched with interest by those connected with geodesy, as success in the measurement of the velocity of light to a high degree of accuracy might open up a new field in the measurement of distances. The difficulties due to lateral refraction in our present system of carrying distances through the measurement of angles would be practically eliminated if the distances to a point could be obtained with the required accuracy, by the time of transmission of light to and from the point.

The economic advantages arising from the prosecution of geodetic surveys are rapidly becoming recognized, as insured by the extensive use made of this form of surveying by all the larger countries. That this science is a practical necessity and that the nations of the world are beginning to realize this fact is shown by the holding of the International Union of Geodesy and Geophysics at Rome, at a time when the world has not yet become accustomed to the burdens and tremendous problems bequeathed it by the Great War. Twenty-one countries were members of this association in 1906, and it is expected that all countries of importance will be represented at this meeting at Rome.

Mr. RANNIE: In moving the adoption of this report I would say that the United States Coast and Geodetic Survey claims an accuracy for precise traverse almost equal to that of primary triangulation, and that this claim is verified by the experience of the Geodetic Survey of Canada. It is not claimed that precise traverse could supplant primary triangulation, except in very flat wooded country. It could, however, supplement primary triangulation. The traverse does not cover the area which primary triangulation covers, and the fact that it is a single line only, whereas primary triangulation consists of a number of lines, gives primary triangulation a stability and advantage impossible to obtain by traverse. In many sections of Canada precise traverse will be an important feature in future. The Prairie Provinces will, undoubtedly, be one of the sections where traverses, by supplementing triangulation systems, will be of immense value.

Mr. BLANCHET: I would like to ask how the positions of the two stations were fixed.

Mr. RANNIE: The traverse was started and closed on different primary triangulation stations.

Mr. AKINS: I second the motion that the report of the Geodetic Committee be accepted as read.

LAND SURVEYS COMMITTEE

J. J. Stock, D.L.S., Chairman.

I am sorry to have to say in connection with this committee that I am bringing in no report. It seems that there is an overlapping of the two committees, the topographic and land surveys. The recent extension in surveys in Western Canada has been along topographic lines and in view of this fact and the fact that Mr. Boulton put in a very comprehensive report last year, which owing to lack of space we were unable to publish in the Annual Report, the committee felt they would not presume to improve on Mr. Boulton's report. I would like to say that I think the Topographic Surveys committee and the Land Surveys committee should be combined.

REPORT OF THE COMMITTEE ON TOWN PLANNING.

G. H. Herriot, D.L.S., Chairman.

In preparing this summary on the progress made in Town Planning in the several provinces of our Dominion during the year 1921, the directors of Town Planning in those provinces that had already organized Town Planning Commissions, and the provincial secretaries in the provinces where no such organization existed, were communicated with and requested to furnish whatever information they could, relative to the matter.

1. Prince Edward Island: No reply was received to my letter of enquiry.

2. Nova Scotia: The report from the Minister of Public Works and Mines states that no progress was made in Town Planning in 1920. No applications were made during the year by towns etc. to come under the act.

3. New Brunswick: The Deputy Provincial Treasurer reports: "We have no Town Planning scheme in this province that I know of. St. John may have a City Scheme."

4. Quebec: The Provincial Secretary referred the enquiry to the Secretary-Treasurer of the Quebec Land Surveyors' Corporation who reports that he does not know of any progress made in Town Planning in Quebec in 1921.

A meeting of the Town Planning Institute of Canada was held in Montreal during the summer. The papers submitted at the meeting and published in the Town Planning Institute's Journal deal with the planning problems of Montreal and are well worthy of serious study.

5. Ontario: The information for this province was submitted by Horace L. Seymour of the firm of Barber, Wynne-Roberts and Seymour. Mr. Seymour

is now retained as City Planning Consultant to the City of Niagara Falls, Canada.

As a result of a resolution drawn up at a conference of the Ontario Town Planning and Housing delegates, held October 31st, and November 1st, in Toronto, Mr. Seymour prepared a small pamphlet giving a compilation of Town Planning Legislation in the Province of Ontario. Mr. Seymour also mentioned the short course in Town Planning offered by the University of Toronto in January of the present year. He stated that the results not only in actual work, but also the advance of public opinion along Town Planning lines, may be considered fairly satisfactory.

6. Manitoba: Report by E. W. Hobbs, Comptroller of Town Planning. This position was created in 1921 although the original Town Planning Act was passed in 1916. Most of the work to date has been educational. Mr. Hobbs says of this: "We hope, however, that this is the seeding time, and that a bountiful harvest will be reaped in the years to come."

7. Saskatchewan: Report submitted by W. A. Begg, D.L.S., Director of Town Planning of the Department of Municipal Affairs, Regina.

Mr. Begg reports the comparative figures for the time the Act has been in force.

	1919-20	1920-21	1921 to date
No. of applications	58	116	67

Concerning the Lens town planning scheme he reports that the Act does not apply in some particulars, and very little development has taken place.

No local authority has as yet adopted a town planning scheme, but a few centres are working on a draft bylaw.

Mr. Hawkins, D.L.S., soil analyst at the University of Saskatchewan, Saskatoon, also submitted some interesting material. His letters are copied herewith:—

University of Saskatchewan
Saskatoon, January 25th, 1922

G. H. Herriot, Esq., D.L.S.,
Topographical Surveys Branch, Ottawa, Ont.

Dear Mr. Herriot:—Replying to your kind letter of the 29th. December advising that I was a member of the Town Planning Committee of the D.L.S. Association, I should like to draw the attention of the members to two matters that came under my observation during the past summer.

The first point is, that, in the University of Wisconsin, under the direction of Dr. Aust, they are making energetic and successful efforts, to extend

PLANNING to the rural districts, where it seems to me there is quite as much material upon which to work and also as much necessity for proper planning, considering the extremely critical position of Rural municipalities all over Canada and the United States.

In Canada, I speak with some first hand knowledge, when I say, we have far too many road allowances and too few roads. If planning were adopted in Rural communities, an effort to condense settlement would be one of the first considerations but with our haphazard methods, miles and miles of road allowances are laid out that cannot possibly be called roads. Maintenance with the present scattered population is out of the question as the financial conditions of the provinces will not permit of the necessary expenditure.

Another point of most vital importance is the fact that a very large percentage of the road allowances are not in suitable locations for roads, and under the arbitrary system of subdivision at present in vogue little opportunity is offered to locate a road properly.

Our highways are just as important to the country as our railroads, and in some instances cost as much or more. In the State of Wisconsin, one trunk highway under construction during the past summer was costing $43,000 per mile; surely then as much care and attention should be devoted to the proper location, having in view grades, soils and the country to be served as is given to the location for a railway.

The second point to which I wish to direct your attention is the enclosed copy of a letter that I sent the Council of The Town Planning Institute of Canada, calling their attention to a subdivision that was about to be made or under way, of an Indian reserve, and pointing out the admirable opportunity to plan the area properly before it should be thrown open for settlement.

These are points that seem to me to be well worth consideration by the Association and can very well come from the Town Planning committee. It opens a field to Surveyors that with effort may be made to yield work, not only remunerative but of a fascinating and interesting character and is practically untouched at present.

Besides all this, until some intelligent, reasonable, and obvious system of planning is adopted for rural communities the present most unsatisfactory conditions are not going to be greatly improved by the quack nostrums and palliatives that are being offered.

Yours truly,

(Signed) A. H. Hawkins.

P.S.—I have just received a letter from the T. P. Institute enclosing a reply from the Indian Department in which they point out as the land is now surveyed it would be impossible to submit it to planning but I shall take occasion to reply to this later and will send a copy of my letter to the new committee.—A. H. H.

—Copy—

Dr. Deville, 12th. October, 1921

President, Town Planning Institute of Canada,
Royal Bank Building, Ottawa, Canada.

Dear Dr. Deville:—I have information that the Department of Indian Affairs are contemplating a subdivision of the Muskeg Indian Reserve No. 102 and the Mistawasis I. R. No. 103 situated in Tps. 46, 47, 48, 49, Ranges 5, 6, 7, west of the Third meridian.

It is reported that there is much good agricultural land in these reserves, and as there are doubtless hills, ravines, lakes and rivers within their boundaries, it occurs to me that it would be rather a pity to have them subdivided and placed on the market under the D.L. system of survey. It would appear that this would be a most suitable area to be developed by some carefully worked out rural planning scheme, where the homesteads would be laid out and the roads located in positions to best suit the needs and requirements of settlers, and having due regard to topographical features.

Occasions of this kind, I regret to say, are entirely too few in this country, and it would seem to be a great pity if advantage were not taken of the possibility of having this area planned, and laid out in such a way, that excess of road allowances, road allowances in wrong positions, giving one section all hay meadow and another all lake, and many other such incongruities which will occur to you, and which will surely take place under the old system, would be eliminated. It is suggested that this is a case where the Town Planning Institute might very properly interest themselves, not only to show that they are awake to seeing that development of rural as well as urban districts is properly carried on.

A new territory, starting out under proper auspices, having the whole area properly planned in advance of settlement, is in a much better position to carry on successfully than if forced to develop their settlement with regard to the arbitrary lines that they will have to observe if the land is surveyed under the Dominion Land System.

The above points are respectfully submitted and if considered feasible, might be taken up by Council.

Yours truly,

A. H. HAWKINS.

8. Alberta: No reply has been received.

9. British Columbia: Report submitted by J. E. Umbach.

Mr. Umbach, D.L.S., and Surveyor General for the province of British Columbia states that in that province they have no Town Planning Act. In 1921 their Registry Act was revised and certain amendments were made thereto. I am not conversant with the old act, and though he referred me to certain chapters in the revised edition of 1921, as I did not know how the Act read before, I do not know what changes were made. The clauses deal simply with the information to be submitted when registering land in the province and the chief thing to note about it is that before a plan is accepted for registration it must show topographic information whereby the examiner will be able to decide whether the streets are laid out in an economical position, and whether they can be economically developed; further, the Registry Act provides that the new plans shall provide in a proper manner for the continuation of the old streets shown on former registered subdivision plans.

In conclusion I think Mr. Hawkins made a good point with regard to the Indian reserves. It should be given some consideration.

Mr. SEIBERT: Mr. Hawkins has for a very considerable time pointed out the many benefits of rural planning as well as town planning and his letter shows the need of co-ordination between land settlement and town planning and a great many other activities which should be properly co-ordinated. The general public at the present time have taken very favourably to town planning but it seems more difficult to get them to move in the matter of rural development. Even to any person not conversant with rural planning it is apparent that rural planning is at least almost as important if not more important than town planning.

I would like to move the adoption of Mr. Herriot's report.

Mr. SPEIGHT: I would like to second the adoption of Mr. Herriot's report. I may say that town planning has worked very successfully in Toronto but is not making such a good showing in some other cities.

Last spring I had occasion to travel quite extensively south of the line and I must say that when I came back and stopped at Niagara Falls I was ashamed for our country, for the condition of that town is disgraceful. Surrounded by natural beauty as it is, it is a shame that it should be laid out as it is. Mr. Seymour has great scope for town planning there. The conditions of the streets are a disgrace to Canada, and I hope the propaganda being distributed will have a very great effect in improving Niagara Falls.

In Toronto the University offers a series of lectures by experts on the different branches of town planning and a great many interested men are taking advantage of this course. I have no doubt that the lectures will be published, and will come within the reach of those who cannot attend them.

Mr. NELLES: I might say in connection with town planning, that Montreal Town Planning Institute held a meeting with the civic authorities of Montreal with the object of increasing interest in town planning and the papers are all very good, and a number of them are published in the various technical magazines and in the Institute Journal.

The chief problem down there seems to be the classification problem. The street car system is congested and they have to relieve that by a tube and busses; another thing that they consider doing is to have some method of transporting poor people to Mount Royal Park.

In Hamilton Mr. Nolan Cauchon has been called in, in connection with town planning, and drew up a plan for Hamilton and Hamilton is now constructing a road on a three per cent. grade. An important thing in town planning is to pay attention to the grade of the roads. This is a question of economic and scientific engineering. If you lay out towns, remember to keep the grades of the street low.

In London Mr. Nolan Cauchon was also called in to investigate the railway problem and has made recommendations which they are carrying out in part now and intend to carry out in full later.

With regard to Mr. Hawkins' letter, this was received by the Institute and the Institute wrote a letter to the Commissioner of Indian Affairs and recommended that a rural planning scheme be put in the two reserves in order to make the community much more healthful, and we received a letter that as it was already subdivided it was impossible to consider the matter.

In future the surveyors when subdividing might try to find out whether it would not be possible to put in a rural planning scheme.

The Town Planning Institute has now about 200 members and is getting in about one-half dozen every month. The fee is $5.00 a year, and the requirements are a commission as a D.L.S. or membership in the Engineering Institute of Canada. The Institute Journal is published every two months and contains very good coloured illustrations and perhaps some line cuts. The subscription is $2.00 per year and Mr. Buckley is the editor.

We have many subscribers in the United States and have received many compliments about the magazine. They say it is the liveliest magazine of its kind in America, and this, coming from Americans, speaks very highly for the magazine.

Mr. SHAVER: With regard to the plan of Lens, it was prepared I think in the Surveyor General's office, and I understand a number of copies were made. It was supposed to have been published in the Institute Journal.

Mr. McELHANNEY: This plan was published in the Institute Journal last August.

The meeting then adjourned to attend the annual luncheon held in the Chateau Laurier.

HEAD OF CIRCUS VALLEY

LUNCHEON AT THE CHATEAU LAURIER.

The Annual Luncheon under the auspices of the Association of Dominion Land Surveyors and in connection with their Fifteenth Annual Meeting was held at the Chateau Laurier on Wednesday, February 1st, 1922, where 115 members and guests assembled.

The President, Mr. G. H. Blanchet, presided. At his right was Hon. Charles Stewart, Minister of the Interior, and at his left, Hon. Dr. Roche, formerly Minister of the Interior, now Chairman of the Civil Service Commission and Dr. Deville, Surveyor-General.

At the request of the President, the Secretary, Mr. W. L. MacIlquham, presented regrets at their inability to attend from W. W. Cory, Deputy Minister of the Interior; Col. J. S. Dennis; Col. Leckie; Senator Casgrain; C. A. Magrath, and others.

THE PRESIDENT: Gentlemen, we all look forward to our annual convention as an opportunity to get together, to renew old acquaintances, and to make new ones. On this occasion we are fortunate in having an opportunity to meet the Honourable Charles Stewart, Minister of the Interior, in whose department many of us are employed. The Association strongly endorses the choice for this important office not only of a Western man but of one who from his public services in the past is particularly well informed on western questions.

I would like to direct Mr. Stewart's attention to the fact that the membership of this Association is drawn from all parts of the country. In their work also they have occasion to cover large areas in practically every section, though particularly in Western Canada. There is probably no point of any importance between the head of the Great Lakes and the Rocky Mountains concerning which some of our members is not accurately informed; and this information should be of service in assisting in the solution of some of the problems with which the country is now faced. I am sure that I voice the sentiments of the Association in offering Mr. Stewart our co-operation so far as it may be of service and extending to him our sincere good wishes for the future.

Before asking Mr. Stewart to address us I wish to discharge a commission I undertook last summer. When in the vicinity of Fort Providence on the Mackenzie River we encountered a band of destitute Indians, one of whom came over and asked us if we were working for the Government. We replied that we were. "Well," he said, "When you go back I want you to tell the Government that the Providence Indians are very short of birch bark." I am sure that it is only necessary to mention such an important matter to have it attended to. (Laughter.)

I now have much pleasure in calling upon Hon. Mr. Stewart.

ADDRESS OF HON. CHARLES STEWART.

Mr. President and Gentlemen: I have had very many pleasant duties to perform in a somewhat short public career, but I think I can number this occasion among the most pleasant. I have a very deep sympathy with the land surveyors, and I am indeed honoured to be their guest to-day. The deputy in charge of the department of public works in the province of Alberta, over which I had control,—Mr. Charlesworth—was a land surveyor, and had the difficult task of initiating me into the mysteries of that department, under the jurisdiction of which, of course, was the work of the Surveys Branch.

I was wondering this morning what I could say to a body of men such as you are. I have at times had regrets concerning some of my utterances. We have an organization in Alberta known as the U. F. A. For some years it was my pleasant duty to speak to the members of this organization on the occasions of their annual meetings. I invariably gave them a great deal of encouragement—largely from the social aspect of their organizataion; but one day they suddenly decided to go into politics, hence I am in Ottawa and they are in Edmonton. I feel, however, that I am quite safe on this occasion. I can refer to my old friend Dr. Roche who is sitting here, who was in charge of this department long before I was thought of and who gave very splendid service. Let me say that so far as I can ascertain, every gentleman who has held the portfolio of Interior seems to have done more than good work. So far as I have been able to ascertain during my short tenure of office, there is nothing in the department that needs very much change; later, of course, as development proceeds, some changes will probably be necessary. I had some hesitancy in coming to the Capital, but I felt that if I were fortunate enough to secure this Department my difficulties would be at a minimum, and I am glad to say that I have found that to be the case.

I am going to say something to you about my first acquaintance with surveyors. In this province some years ago I was chosen by the municipal council to act in the capacity of a fence-viewer. Now, the duties of a fence-viewer, which are familiar, I know, to some of you Ontario surveyors, usually brought him closely in touch with gentlemen of your profession. In this case the man in charge was, I believe, Mr. Stewart of Collingwood, an Irishman; there was myself, of Scotch persuasion, though you wuldn't know it to look at me; and the surveyor. When the owners of the property in question turned up, to my consternation I found that one was a Jew and the other a Scotchman! I have great admiration for the clever way in which the surveyor handled these two gentlemen: it was the case of a stump fence filled with stones, and it was a question of moving it out some two feet. Indeed, I have always thought commendable the diplomacy of the members of your professison in dealing with intricate questions of that character.

In Western Canada we know you, of course, as men who go to the outskirts of civilization. Only a year ago I was in the vicinity of Fort McMurray, which, as many of you who have worked in the province of Alberta know, is a considerable distance to the northward. Having become lost in a snowstorm on a moose-hunting expedition, we came across one of the trails used by pack animals for carrying supplies to the surveyors' camp. All these things are very interesting; and I sometimes wonder how you settle down to the humdrum routine of indoor existence after carrying on work in which you come so close to nature. In fact, I have sometimes thought, when harassed by matters connected with public affairs or when besieged by delegations both day and night, that I myself would not mind being a land surveyor in the north country for a period of five or six months!

But after all, gentlemen, it is not about your profession that I want to speak to you to-day; I wish to say something to you as men who are vitally interested in Canada, particularly, as your President has suggested, in Western Canada. I am intensely interested in Western Canada: I believe that it presents opportunities to the young men that are not to be found anywhere else, and I hope to see there a very large population. But sometimes we get a bit discouraged out there; and perhaps the present is a time when discouragement seems to be stalking fairly close to us. After all, we are very optimistic. It is said of us in the West that we are the greatest "next year" people on the face of God's green earth; and I think that is true. We hope that next year we shall see improvement. Sometimes we search about to find the real cause of most of our difficulties, and I have come to the couclusion—I may be wrong; Dr. Klotz, who has not only seen the West at a much earlier period than I have but has seen life for more summers than I have, may not agree with me—rightly or wrongly, I have come to the conclusion that the thing that is the matter with the people in Canada is traceable to a mental condition. Perhaps it is the result of conditions that prevailed during the war, when our whole activities were directed to one great purpose, and of our swinging back now into another condition, running perhaps too far in the direction of extravagance and, possibly, over-expectation. Because one cannot help being struck with the fact that even since the conclusion of the war we have made great strides, and our progress shall be even greater if we get to a normal mental condition in Canada generally; for this applies not only to one part of the country, but to the whole of it. If, I say, we get back to a normal mental condition—and that involves our getting away from extravagances—I do not think we need worry very much about the future of Canada.

As a government we are confronted with very large questions. The largest one would seem to be that which is of a financial character. But after all, that is not the most important thing, though at the moment it is one of the large questions that we have to face. Many suggestions may be made with a view to remedying that condition in greater or lesser degree; but the main thing, I think, is the attitude in which we approach it. We have to look for leadership to men who are occupying positions of prominence. Perhaps you will say that leadership should be furnished by the Government. Agreed, to a certain extent; but it must be supplemented by the lead of men in organizations such as that which you represent here to-day—trained men, professional men, men imbued with the get-together spirit, men who are in a position to back up all effort looking to the bringing about of better conditions throughout Canada as a whole. If in Western Canada—and I trust you will not feel that what I have to say in this regard is actuated by any egotistical feeling—the Government of which I had the honor of being the head received any credit, it was the result of our keeping very closely in touch with the people whom we sought to represent. So long as I occupy the position in which I find myself to-day I shall look to organizations of this kind, to men in every walk of life who have the real interest of the Canadian people at heart, to lend their active assistance in the building up on this part of the North American continent a nation of which we may all justly feel proud. I thank you, gentlemen. (Applause.)

The PRESIDENT: I am sure that we all appreciate Mr. Stewart's analysis of the situation, and that we respond heartily to his note of optimism.

Anyone familiar with the Dominion land survey system of Western Canada must be impressed by its magnitude and by the high standard which has been maintained since its inception through the stormy times of boom and depression. It was by no means obvious why this standard should be maintained, to one viewing the matter from the small altitude of time and place but required the broadest vision and no small amount of courage. To Dr. Deville, who as Surveyor-General has directed the policies of this work, belongs the credit for the result achieved. (Applause). Dr. Deville has been patron of this Association since it was organized, and has given us on a great many occasions the benefit of his support and advice. His remarks at our luncheons are always instructive and interesting, and I now have much pleasure in calling upon him to address us.

DR. DEVILLE'S ADDRESS.

Mr. Chairman and Gentlemen: The magnitude of the work carried on by the surveyors, to which our chairman has just alluded, is not realized by the public. People have some idea that there are surveyors employed, but they do not realize the extent of the work that has been accomplished, and it seems to me that this is an appropriate occasion to insist upon that aspect of the question.

If we take the Dominion from its eastern end, we find that in the Maritime provinces the Geodetic Survey has been carrying on very extensive work.

They have a triangulation extending over the Bay of Fundy, from the south end of the Bay to Truro and easterly toward Cape Breton. This triangulation is completed from the Bay of Fundy and is now extended toward Cape Breton with a view to connecting with St. Paul Island and Newfoundland on one side. On the other side it is extended between Prince Edward Island and the coast of New Brunswick with a view to connecting with the triangulation of the St. Lawrence. The triangulation of the St. Lawrence is fairly well completed from Lake Huron to Pointe de Monts and is being extended eastward toward Anticosti Island and the Strait of Belleisle. In Ontario they have been doing a good deal of work here and there. As to more westerly areas, last year a triangulation was started along the forty-ninth parallel. The United States Coast and Geodic Survey are doing the western half from a point a little east of the Rocky Mountains to the Pacific, and the Geodetic Survey of Canada are doing that part of it which extends from Lake of the Woods to the point where the work of the United States Coast and Geodetic Survey commences.

Along the coast of British Columbia, too, they have been doing a great deal of work, northerly from the United States boundary toward the Queen Charlotte Islands. The work there is rather slow because of the prevalence of fog, but good progress is being made.

In addition to the work which I have mentioned, an immense net of precise levelling is extending from ocean to ocean and its scope is being increased. The International Boundary Commission have pretty nearly completed their work. At present they are mostly engaged in the preparation of their report, although there are still a few places where some work is required.

Coming now to the activities of the Topographical Surveys, perhaps the most important part of their work has been the revision of the sectional maps which are being transformed into topographical maps. We have now revised fourteen of these maps, and they are very complete, showing everything that is of importance. We have taken into account the fact that the motor has come to stay, and we are paying particular attention to the classification of the roads. They are divided into four classes, according to their condition. These maps show everything that is of interest on the land—churches, schools, elevators, and so on. To give you some idea of the need of these maps, I may say that only a few days ago we received an order for a thousand copies of one of them—and of course they are paid for; we do not give any of them away.

Last year we had a very important expedition down the Mackenzie River. We required an accurate survey of that river, for several purposes. In the first place, it was required by the Geological Survey, to whom we were under contract to deliver the maps complete by the thirty-first of December. I am glad to say that there was no delay; the maps were delivered on time. These maps are required also for navigation purposes. There are a good many places along the Mackenzie river and on the lakes where navigation is somewhat dangerous, the banks being low and passage among the intricate channels difficult. We have made a complete survey of all these places and will have the maps ready by the opening of navigation. We have established beacons at the most difficult points, and navigation, I think, will be pretty well provided for. That work has involved the survey of some four thousand miles; and when you consider the distances in that country and the conditions under which the work had to be carried on, I think you will agree that the results attained have been little short of wonderful. I may point out that the Carcajou river, the last point reached on the Mackenzie in connection with that survey, is some fifteen hundred miles from Peace River, the starting point. This year we purpose to go very much further and to reach what may become the metropolis of the North, that is, Aklavak, in the delta of the Mackenzie River, where the Mounted Police are going to establish an important post, and where some people have already settled.

In addition to the work which I have briefly outlined we have been doing a great deal of classification work—classifying land according to its fitness for settlement. We examine every section of land and describe it in such manner that the man who is looking for land upon which to settle can base his selection upon proper information. We have examined some seventeen million acres—which, as you can easily understand, involves quite a lot of work. A great deal of it has been done for the Soldier Settlement Board; in fact, ten million acres were examined at their request. We also made a cursory examination of some seven million acres in addition, to find out whether it was worth while to look further into the matter. We have also been assisting the Soldier Settlement Board in their endeavour to locate returned soldiers on the land, and I think they have found our assistance of great value.

Another line of work that has been pursued by the surveyors is the resurvey of dried-up areas included in land subdivided many years ago. As you all know, many parts of that western country are drying up; lakes which were rather extensive at the time of the subdivision are now nearly all dry land, some of them entirely free from water. With a view to finding out how much land is now available we started a re-survey a few years ago, and I expect that it will be completed within a short time.

Surveys of interprovincial boundaries have also been proceeding. A survey of the boundary between Alberta and British Columbia has been in progress for several years; we have already published one report upon it—a very good report, too. The boundary between Ontario and Manitoba is also being surveyed north from the Winnipeg River, and will be extended a little further. This is a very necessary work, because there is involved the question of jurisdiction, not only as to ownership of the land but also to the application of provincial laws and the administration of justice.

A great deal of miscellaneous work other than that which I have mentioned is carried out by the land surveyors—work connected with town planning, timber limits, mineral claims, and so on. I think that this short enumeration of the activities of land surveyors will bring about a better appreciation of the magnitude of the work that has been and is still being accomplished.

I thank you, gentlemen, for your kind attention. (Applause.)

The PRESIDENT: Gentlemen, we have also with us to-day the Honourable Dr. Roche, Chairman of the Civil Service Commission. Dr. Roche, both in his former office of Minister of the Interior and in his present capacity as head of the Civil Service Commission, has always maintained a friendly attitude toward our Association, and in connection with any matters which we have had to bring before him has met us in a sympathetic spirit. I have much pleasure in asking Dr. Roche to address us.

DR. ROCHE'S ADDRESS.

Mr. President and Gentlemen: Another year has rolled round since last we met at this festive board on the occasion of a similar gathering held under the auspices of your organization. We have had five different ministers of the Interior since 1911, and I am pleased indeed to see Mr. Stewart following in the footsteps of his predecessors in attending this feature of your interesting conventions. I myself have had the privilege and pleasure of attending them annually for the last number of years.

Mr. Stewart has said that before coming here he was a little in doubt as to what he should say to you. If Mr. Stewart was a little in doubt in that regard, what a serious handicap must I labour under, who have been here for the last ten years, meeting with much the same audience, disliking to repeat myself too frequently, and finding it somewhat difficult to break new ground! During the past year many changes have taken place; many notable events, both national and international in their character, have marked the world's history. In some of these Canada has taken a very important part. Take, for instance, the Prime Minister's Conference which assembled in London, England, last summer, where the representatives of the overseas British dominions met the representatives of the British Government for the purpose of discussing matters pertaining to the welfare of the British Empire, matters of an inter-Imperial character as well as effecting international relations between the Empire and other countries. Here was shown the important status which Canada, in company with her sister dominions, has been attaining as a result of the growth of British parliamentary institutions and the natural evolution of events. This additional status, this condition of co-operation and copartnership with the Mother Land, has been brought about without the slightest impairment of that local autonomy which has for many years been enjoyed by the British possessions.

Then, again, there is that more recent event of a very important character, the settlement of the Irish question, a question that has been the bone of contention between the peoples of Great Britain and those of Ireland for the last century and a half, and a thorn in the side of every British Government that has held sway during that time. While it is essentially a domestic question, it is one in which every British subject has been deeply interested—in fact, one which has been followed closely by every lover of peace, whether a British subject or not. While the settlement has not been such, apparently, as to commend itself to the extreme elements in the respective countries, still, I think we may fairly assume that it is an honourable and a fair compromise which is approved by the great majority of fairminded people of both countries.

Apropos of the Irish question, I am reminded of a story—and by the way, am a very poor story-teller—told by that celebrated raconteur, Mr. William White of Pembroke. I may have told it before, but it will bear repetition. It appears that in that town there were two wags, one a Frenchman and the other an Irishman, each of whom dearly enjoyed a joke at the other's expense. It happened on one seventeenth day of March—a day not unknown to most Irishmen—that Pat was seen hurriedly making his way down the street at a very early hour in the morning, as if on some particular business intent. The Frenchman, who himself happened to be out at that time and saw Pat hurrying along, called out:

"Hello, Pat!" "Where are you off to so early in the morning?"
"Where you ought to be going," was the reply. "I'm going to mass".
"And why to mass this particular day of the week?"
"Because this is the seventeenth of March, St. Patrick's Day".
"St. Patrick's Day? Whoever is St: Patrick?"

The Irishman looked at him in amazement, and then said: "You dunderhead! I would have you understand that St. Patrick is Ireland's patron saint—the man who drove the snakes out of Ireland!"

A look of surprise came into the Frenchman's face, then he said:

"Drove all the snakes out of Ireland ? Well, he had damn little to do! If he had driven out the Irish and left the snakes, Ireland would be better off to-day!" (Laughter).

However, gentlemen, those who, like myself, are of Irish extraction, will scarcely harmonize our views with those of the Pembroke Frenchman; for after all, what would Ireland be without the Irish ? Now that they have won their hard-earned laurels, let us hope they will demonstrate to the world that they possess the genius of government and know how to appreciate the privileges which have been recently conferred upon them.

Another gathering world-wide in its character and of a most important nature is that which is just drawing its labours to a close—the Washington Conference to consider the limitation and reduction of armaments. This conference represents one of the greatest strides toward better things that has been taken in our day and generation. The assembling of representatives of some of the most important countries at a round table conference for the purpose of devising ways and means to relieve the taxpayers of the enormous burden involved in the mad race for armaments—in itself an incentive to war—is an occasion the parallel of which we have never witnessed. And while the results of that conference may not be such as to meet the wishes and the aspirations of some of the more optimistic and enthusiastic advocates of disarmament or limitation of armaments, still, I think we must all admit that splendid results have been achieved—results which we hope will prevent the recurrence of that terrible catastrophe which wrought such havoc in the world between 1914 and 1918. In this connection I am sure it is a source of satisfaction and gratification to every British subject to know the splendid attitude that was taken by the representatives of the British Empire at that conference. Notwithstanding the fact that Great Britain is a maritime nation, that her national existence depends to a very great extent on her navy, Mr. Balfour and his associates immediately accepted the proposal of the President of the United States providing for sweeping reductions in war armaments. In fact, they even went further and were the originators of the proposal for the total elimination of some of those more barbarous methods of warfare that figured so conspicuously in the recent world struggle. Particularly is it gratifying to Canadians as well as to other British subjects to see the manner in which the representatives of the British Empire have worked in close co-operation and harmony with the representatives of the great republic to the south of us; two branches of the great Anglo-Saxon race with one object in view—the cultivation of international amity and good will, and the preservation of the future peace of the world.

Here in Canada during the past year we have really had no great upheavals of a national character,—unless you are pleased to look upon the event of December 6th in that light. But we in Canada have grown somewhat accustomed to these changes that come round with more or less regularity in the natural cycle of events. On the whole we accept them philosophically and soon accommodate ourselves to the changed order of things and pursue the usual even tenor of our way. Canada is gradually resuming a normal condition after the dislocation that took place as a result of the war—and this, gentlemen, without the irritation, without the unrest and disturbance that has been characteristic of the post-war period in almost every other country. To be sure, we have our national troubles and difficulties; our problems, our obligations, financial and otherwise, to meet; but we have every confidence in the sanity of the Canadian people as well as their capacity to deal with these matters in a statesmanlike manner.

Now, one year ago, speaking at your convention on behalf of the Civil Service Commission, I had the privilege of announcing that it was the intention of the Civil Service Commission to recommend to the Governor in Council that chiefs of parties, whose positions in the past had been looked upon in the light of seasonal positions, be made permanent employees in the Civil Service. These men spend a portion of the year in the field, and perhaps, at the termination of the field season, a certain length of time at headquarters in the preparation of reports; but usually an interregnum occurring between the time of the completion of their work and the beginning of the next field season. The result was that members of your staff were in uncertainty and doubt as to whether their names were going to be included on the next season's list. While that step was not taken as expeditiously as we at one time thought it would be owing to difficulties of an unexpected character that cropped up, I am pleased to be able to say that eventually an Order in Council was passed in the matter, and those who were recommended by the Department and approved by the Commission—always, of course, giving preference to the returned soldier—were, so far as the appropriation of the year would permit, made permanent in these positions. Those who have hitherto been in a state of uncertainty as to their future will, therefore, have that anxiety removed and will be entitled to all the rights and privileges of the average civil servant. I am sure that those who were thus made permanent will highly appreciate this privilege; it should be a stimulus to renewed effort in the discharge of their duties and even more efficiency than they have displayed in the past.

We should all be animated by a sincere desire to see built up in this Canada of ours a highly efficient, highly trained Civil Service of which we may justly be proud. Anything, therefore, that your organization may be able to contribute toward this end, either by way of practical suggestions or in the line of actual achievements, through either united effort or united co-operation, will be gladly welcomed so far as Civil Service Commission is concerned. No man or body of men, great or small, can justly claim to have a monopoly of wisdom on any subject. It is only by conference, by interchange of ideas, that we get the broader view and that we can come to just and fair decisions on the questions that from time to time arise for adjudication.

Our universities and colleges have during the last few years been enlarging their courses, extending their terms, and exacting a higher standard of qualification through entrance examination and otherwise, with the object in view of turning out persons trained in the best possible manner to cope with present day conditions. There is no reason why the Civil Service of Canada should not keep pace with our universities in this respect by requiring a higher standard of efficiency; by making examinations more practical than in years gone by; by having merit as the basis for advancement in the service, as well as by cultivating *an esprit de corps* among themselves personally. Canada has, in recent years particularly, been attaining a higher standing among the nations of the world, in consequence of which she has assumed obligations and duties of great responsibility and importance. In order that these duties and responsibilities may be efficiently discharged it will be necessary for us to enlist the services of the best and brightest intellects in the country, backed up by an enlightened and educated public opinion to strengthen and support their efforts. The Civil Service of Canada can do a great deal in this direction. While the Government of the day is naturally the guiding and directing force, the Civil Service is really the power behind the throne, the power that supplies the punch. Gentlemen, do not misunderstand me; I do not use this word in its alcoholic sense; for I realize that we are living in a very arid age and place, particularly on this side of the Ottawa river. By the way, I notice that some of the more enterprising citizens of Ottawa have evidently come to the conclusion that the usual methods of transportation between Ottawa and Hull are somewhat antiquated and rather too slow; hence they have devised a new and swifter, if not safer, method of transportation via the toboggan slide. My information is, however, that the return trip is made in the same old way: you may attach whatever significance you like to that comment. I say this, of course, for the benefit of out-of-town visitors; the residents of Ottawa do not need any advice on that score. (Laughter.)

I thank you, Mr. President and gentlemen, for extending to me an invitation to be present with you on this occasion. I wish your Convention every success. (Applause.)

The proceedings were concluded by the singing of

GOD SAVE THE KING.

SOUTH END OF TONQUIN VALLEY FROM MT. CLITHEROE

WEDNESDAY, FEBRUARY 1st.

Afternoon Session.

THE CHAIRMAN: The first item on our programme this afternoon will be an illustrated lecture on "Our National Parks" by Captain Forster of the Parks Branch.

OUR NATIONAL PARKS

BY CAPT. FORSTER

Mr. Chairman, Ladies and Gentlemen,—I did not understand that it was a paper I was to present this afternoon and I have come prepared to talk quite informally to you along the lines of the development of Canadian National Parks and the place that Canadian National Parks may have in the reconstruction of our Dominion.

What Canada needs to-day is that every citizen should give of the best that is in him or her as the case may be. It is work and more work. But if man is to work with the highest efficiency he must have recreation and what better place for recreation and holidays than the Canadian National Parks.

The Canadian National Parks are areas set aside for the good of the people for all time. They consist of seven parks in the West—Rocky Mountain Parks, Yoho, Revelstoke, Jasper, Waterton Lakes, Buffalo and Glacier. These are great parks for the attraction of tourists, both in the Dominion of Canada and from countries afar. We have three parks that are looking after the preservation of certain wild animas of Canadian type, such as Wainwright, for the preservation of buffalo, Alpine Forest Reserve Park in which are certain antelope that were fenced around in their wild state. Within that area they are prospering and that which was really threatened with extinction has been saved for our country and is one of the centres of attraction.

Canada ought to be the summer play-ground of the North American continent. Down in Quuebec I was riding along a lake on which were a colony of beautiful residences and I asked where all these people were from, and discovered they were all from away down south. They had come to Quebec long before the Prohibition laws in the United States came into effect and it was not a matter of the development of these laws. It was because they found the climate and beautiful scenery there, and we have these same advantages of scenery and climate in other parts of Canada which are just on the eve of development and that will prove great Government revenue producing factors in the making of our country.

In France the revenue before the war from tourist traffic has been estimated conservatively at five hundred million dollars per year. The revenue of

Switzerland before the war conservatively estimated has been placed at one hundred and fifty million dollars per year, Italy one hundred million dollars annually, Germany over four hundred million every year. The people of the United States as far as I can find out before the war spent upwards of three hundred and fifty million dollars every year going to Europe.. During the war the submarines cut this off and the people of the United States turned to tourist traffic within their own country.

Ladies and Gentlemen, I believe that as a matter of revenue in our country, our Canadian National Parks have a great future. Men have been coming to us from England, enthusiastic Alpine climbers have come from Europe, and they have gone away to come back, men in increasing numbers have been coming in from the United States. Now that we have linked up our Western National Parks with the great National Park system of the United States, you may come by automobile from the National Parks of the United States through Lethbridge, Calgary, Banff, Vermilion Range, and back again by Spokane, Seattle and Los Angeles, connecting up again with the great National Parks of the Republic to the south.

I need not speak to you of Banff as a holiday centre; enough to say that in that particular centre the Canadian Park system has for the accommodation of the tourist traveller six well ordered hotels, there are also the famous sulphur baths, the Sun Dance Canyon and Johnston Canyon and many other attractions which I need not repeat to you to-day. I would rather let the moving picture speak for itself.

What I want to remind you, however, is this, if you ever take the trip through the West, don't think you see British Columbia by going through on the train and hugging the train line. Get out at Banff, Yoho, Glacier, Revelstoke, Jasper, or some of our other Canadian parks in the west and get in touch with one of the guides, always available there, and I venture to say in the two days you spend there you will learn more about British Columbia than if you stayed on the train.

Ladies and Gentlemen, I am much obliged this afternoon for your attention. We will now have three slides first, to show you the road about completed which we expect next July will be in such a condition that automobiles will be able to travel in a complete circle all the way from Lethbridge to Calgary, Banff, Vermilion Range, Crowsnest and back to Lethbridge.

THE CHAIRMAN: We have all greatly enjoyed Capt. Forster's address and the pictures of the National Parks of Canada, and I wish to extend to him the thanks of the meeting. The next speaker this afternoon will be Mr. Lloyd of the Parks Branch who will give us an address on "Bird Sanctuaries" in Canada.

BIRD SANCTUARIES IN CANADA.

BY HOYES LLOYD.

The Canadian National Parks Branch of the Department of the Interior is intimately concerned with the protection of Canada's wild bird life. It is the Branch which administers the Migratory Birds Convention Act in Canada, that great conservation measure which protects our bird friends when they are otherwise beyond our control because of their sojourn in another country.

In carrying on this work we need your help, gentlemen, for to you much of the broad extent of Canada is an open book and in the course of your travels you can be of great assistance to us. The information on the bird life of Canada which you now have may be of great value to us in carrying out bird protection measures. One important endeavour of the Branch is the protection of the breeding grounds of the water-fowl. Whenever you locate areas you consider important because of the wild fowl that breed there, information concerning the fact would be appreciated by our Branch.

There are many intensely interesting and important discoveries yet to be made concerning some of Canada's birds. Only recently the wintering grounds of a flock of Trumpeter Swans has been made known to us. Until this flock was discovered the species was considered to be verging on extinction. There are only nineteen birds in this flock, and this flock and a few other stragglers may represent, so far as we know, all that is left of one of the most magnificent and also the largest of our birds. The Trumpeter Swan has been known to reach a weight of thirty-six pounds. With your help it is possible that more information may be gained of their breeding grounds, and even though only a few pairs of these birds nested in a locality it would be worth while taking special precaution to protect them.

Another rare bird concerning which any informataion would be welcome is the Whooping Crane—the bird which is known locally in Western Canada as the "white turkey". This species, I fear, is also near extinction. What few migrants there are left will come through central Saskatchewan in the spring and pass on north, how far is not known.

Our information service in bird protection work in Canada consists of several hundred honourary game officers. Members of this Association who may wish to carry on work on bird protection cannot do better than become honourary officers of the Parks Branch so that we may work together for this great cause.

The Migratory Birds Convention came into being because the valuable birds of the continent were being seriously depleted in numbers and according to law. In their southward migration those birds, for which open seasons were provided found themselves continuously harassed, for there was generally an open season for migratory birls covering practically the whole of their stay in any given locality. Then, even in spring, the birds in their northward flight, often mated and preparing to rear their young, were molested. The ultimate result was a Treaty between Canada and the United States which protects three groups of birds.

The insectivorous birds are protected by this Treaty, because of their beauty and utility. Aesthetically they charm us with their songs and beauties of form and colour, while from the purely utilitarian standpoint they are enormously important as destroyers of insect pests in farm, garden, forest and orchard.

You have all seen the birds on the prairies known as the Franklin Gull. I have seen flocks of these birds settling down in the growing grain and devouring the grasshoppers that were destroying the crop. Even in areas where crops were destroyed as a general rule the Gulls saved the crops near the small lakes and sloughs where they nested.

A harmless and interesting group of birds protected by this Treaty is the non-game bird group. This includes such birds as the Heron and many sea birds.

The last great group of birds protected by the Treaty is the game bird group. This is divided so that special protection is given game bird species which have become scarce. One example is the Wood Duck.

For the game birds other than those kinds which are specially protected for a number of years, three and one-half months open season is allowed, and thus the season will not be open during the entire sojourn of a species in any district. At the present time there is no open season for migratory birds later than January 31st in any year in the entire United States. This means greatly increased protection for wild-fowl in the south where there was formerly good shooting until March and it means that an ever increasing number of birds have been able to return to us in Spring.

They return here to nest and here Canada's great responsibility lies—the protection of the nesting grounds. A bird sanctuary is a place of safety—a place where there is no shooting and the creation of bird sanctuaries is one of the important methods for conserving bird life mentioned in the Treaty.

One type of sanctuary is that for small birds—the garden where they are protected from their enemies the house cat, the red squirrel, and the house sparrow, serve this purpose. These can be established by private effort, but more comprehensive effort is necessary to protect our larger fowl.

A most interesting and successful bird sanctuary is that at Bonaventure Island, Quebec. On the cliffs of this island great flocks of white sea-birds nest—they are Gannets; and other species are associated with them in this sanctuary. So successful has this sanctuary been in attracting bird students and tourists that it has been necessary to enlarge the hotel accommodation several times to meet the needs of visitors. It is a wonderful sight the great cliffs afford, crowded as they are with the great birds which flock there.

Probably one of the most important works now under way in bird sanctuary creation is the reserving of marshes and lakes on the great plains. The important water-fowl breeding area of the continent extends from south of the International boundary in Manitoba, Saskatchewan and Alberta northward across the plains reaching generally a line from Norway House to Great Slave Lake. Some few species of ducks and several kinds of geese, however, do reach the Arctic Circle and pass beyond it. This area includes that which is valuable for cultivation, and the draining of every slough and marsh in this area, as a result of cultivation, decreases the available water-fowl area. Throughout this great area the best water-fowl breeding lakes and marshes are being selected and set aside as breeding grounds for water-fowl.

The water-fowl of the Continent depend in a very large measure upon adequate steps being taken for their protection here on their breeding grounds, and we hope this valuable asset will not be lost because of the utilization for other purposes of all the marsh land they need.

In the United States many important sanctuaries are now giving our birds protection. In Louisiana very great advances have been made, both by the State and by private individuals, who have purchased large tracts of land and set them aside for the water-fowl. The United States recognizes its duty in affording protection to these wintering birds—it is our duty to protect the breeding grounds for them.

THE CHAIRMAN: I am sure I am expressing the sentiments of the Association to Capt. Forster and Mr. Lloyd in expressing our sincerest thanks for the facts they have given us. I am afraid there is not time to have the paper by Mr. Bridgland this afternoon on Phototopographic Surveying, but we will have it in the morning.

JASPER AND ATHABASKA VALLEY

THURSDAY MORNING SESSION.

THE CHAIRMAN: It is with great pleasure that I introduce Mr. Bowes of the Naval Service, who will give us a paper on Hydrographic Surveying.

HYDROGRAPHICAL SURVEYING WITH SPECIAL REFERENCE TO JAMES BAY.

BY LEROY T. BOWES

Of the Naval Service Department.

Every day we read of Canada's wonderful advancement in the industrial and commercial world. The buliding of over half a hundred steel cargo carriers as a nucleus of a natural mercantile marine has imposed a definite obligataion on the people of Canada and the recreating of a naval policy, must impress on Canadians that while Canada is essentially a pastoral country that we are also a maritime people with maritime interests. Ships seek our ports and discharge their cargoes of goods needed by our country. Who has not gazed with wonder at the huge masses of wood, iron and steel as they glide into our harbours on the Atlantic or Pacific Ocean or the noble St. Lawrence. Or else laden with the products from our Dominion they slip their lines and drop out into the stream to bear Canadian goods over the trackless deep to the Motherland or foreign countries.

But broad and deep and trackless as these routes may seem navigation of these large craft is only made practicable and possible by careful selection from the charts prepared by the Hydrographic Survey Branches of the British Admiralty, foreign countries and in the case of Canada by the Hydrographic Survey of the Department of the Naval Service. By means of accurate charts, splendid lighting and buoying systems and other aids the Governmental departments concerned with marine affairs are rendering invaluable aid to navigation and helping to secure a high place in ocean commerce and trade development.

The Canadian Hydrographic Survey was really created in 1882, when a wooden steamer "Asia," plying in Georgian Bay and carrying both freight and passengers was lost in a gale of wind and all perished except two passengers. This wreck was considered quite a marine disaster at the time and in the investigation which followed many people were dissatisfied with the evidence that the vessel was top heavy and had encountered gales severe enough to cause a ship of that type to founder. They contended that the "Asia" had struck an uncharted and unknown danger and agitated for a Canadian Survey of our waters similar to that carried on by the United States Lake

Survey. Owing to the special nature of the survey the Canadian Government applied to the British Admiralty for the loan of a qualified officer. Accordingly Staff Commander J. G. Boulton of the Royal Navy was appointed and commenced work in July 1883. In the succeeding year work was begun in earnest a survey steamer having been purchased. At this time Mr. W. J. Stewart, the present Chief Hydrographer, was appointed Captain Boulton's assistant, which position he held until 1893, when Captain Boulton returned to England. The survey under Mr. Stewart, who had been promoted to officer-in-charge with Captain F. Anderson, the present Assistant Chief Hydrographer, as assistant, was placed under the Department of Marine and Fisheries.

In 1904 the hydrographic surveys of the Departments of Marine and Fisheries, Public Works and Railways and Canals were amalgamated and placed under the Department of Marine and Fisheries with Mr. W. J. Stewart as Chief Hydrographer.

In 1905 the Canadian Hydrographic Survey was practically in its infancy and so limited was the staff that the Chief Hydrographer besides the administrative work of the department had to personally conduct a survey ship on the St. Lawrence river. At the present time the Great Lakes and Lake Winnipeg have been charted and there are also charts of Hudson's bay and James bay, portions of the St. Lawrence river and the Atlantic and Pacific coasts available. Now there are four splendidly equipped surveying steamers engaged in surveying the Atlantic and Pacific coasts, the St. Lawrence river and the Magdalen islands. Generally hydrographical surveying is conducted from these steamers, but where a ship is not needed and would be too costly for the survey required small detached shore parties work with motor launches, pulling boats or small sailing craft.

Hydrographic surveying is the work of delineating the bottoms of the oceans, sea-coasts, rivers and harbors to determine the depth of water, the shoals and the channels. The skeleton survey is necessarily a trigonometric one in which primary stations are erected and located. Smaller or secondary stations are established to assist in accurately locating the soundings. These latter may be a whitewashed shed, a conspicuous boulder also whitewashed or a mark of that nature. Included also is the shore line with its characterizations and enough topographical features to assist the navigator to course his vessel past dangerous shoals, reefs and rocks, and to select the limits of the fairway or channel. All conspicuous natural objects are located and artificial ones such a light houses, buoys, range marks or beacons created to lead past dangerous submerged or exposed rocks and banks.

According to leading authorities in hydrographical surveying the work may be divided into three classes: the sketch, ordinary and detailed surveys. The accuracy of hydrographic surveying depends to a large extent on the nature of the work required. In Canada, however, the charting of our waters has reached such an advanced stage that the detailed survey is the one generally employed and every effort is made to attain accuracy and thoroughness. Wherever there has been an opportunity of checking with the Geodetic Survey the results have been gratifying indeed. On the St. Lawrence river from Riviere Ouelle to Cap Chat and Point des'Monts, covering a stretch of over 180 miles the Hydrographic Survey results differed by 1 meter in distance and 35 seconds in azimuth with those obtained by the Geodetic Survey.

The sketch survey is more or less of a cursory examination or rough approximation. Where a large area is to be covered in a limited time and as much information is wanted as can possibly be secured in that time this class is generally employed. The ordinary survey is one conducted and published on such a scale as to show no errors of commission. Its imperfections lie in the numerous omissions caused by the small scale used and the amount of territory covered in the allotted time. The detailed survey is an accurate reproduction of the water area and its vicinity. The scale used is a large one and the soundings are taken so closely together that the danger of missing any obstacles which might interfere with navigation is eliminated. The detailed survey is the method employed in constructing charts of ports, harbours and localities where there is a heavy trade.

One of the most important parts of hydrographic surveying is to secure as many soundings as possible and to locate these soundings with every degree of accuracy. At the present time huge liners and freighters ply our trade routes, enter our ports and skirt our long coastlines, and on the great inland seas vessels correspondingly as large carry grain and other valuable cargoes on their blue expanse. One wrong sounding, either in depth or location, a rock missed. a lump overlooked or a shoal uncharted, and these hugh vessels of tremendous size, weight and value are either seriously damaged or pounded in pieces in the stormy seas becoming total wrecks and losses. Besides, ocean and river trade has assumed such proportions that every means to shorten his sea voyage is employed by the navigator. Good charts have served to expedite matters by limiting the danger line and revealing the true nature of the bottom.

As stated previously hydrographic surveying may be carried on in many ways dependent on the locality, time allotted and the uncertain elements of wind and tide. Generally a running survey is made of the district to be surveyed and large beacons are erected on points selected as suitable for the network of the triangulation scheme by which they are later located. The geodetic position or latitude and longitude of these main points of the primary scheme are as accurately determined as possible and always within such limits as the scale of the work demands. After these main points have been located the smaller or secondary stations are built and their position fixed by one of many methods, i.e. traversed by chain or stadia, cut in by angles from the shore to the fixed points or by using a buoy triangulation scheme and so on. Later these small stations are used as marks to fix inshore soundings and also accurately determine points between which the coastline and shore features are fitted in. The soundings are located by "fixes" or angles taken between the marks mentioned above. The angles are taken with sextants used in the boats when doing inshore sounding or the ship when doing off shore work. Besides determining the position of each cast of the lead line, these fixes assist the surveyor in running straight and parallel lines. Sounding lines vary as a rule from twenty-five to four or five hundred feet apart or even more as occasion demands. Generally out to a depth of twenty fathoms the lines are run perpendicular to the shore at a distance apart of about two-tenths of an inch whatever the scale used. There can be no fixed rule as regards the method of conducting a survey but according to the locality one must exercise his own judgment. Often so many soundings are taken to thoroughly examine an area to show the very least water that the majority of depths secured are unplottable.

After the inshore soundings which have been secured by a motor launch or boat rowed by sweeps, the ship carries the soundings out to a depth of one hundred fathoms, but of course the spacing is considerably farther apart. These soundings are usually obtained by allowing the lead to travel along a carrier from the rear of the ship to the bow and dropped from a boom extended from the side. The heavy lead sinks rapidly and a man at the stern notes the depths while the surveyors with their sextants locate the exact spot. In older times men lined the side of the ship and each dropped over his coil until the least length was out and the depth ascertained. Now the long length of line is pulled in by a steam winch instead of the olden slow and laborious method. The lead line by which the casts are determined may be marked in feet and fathoms or a patent sounding clock may be attached to the end of the line. These clocks automatically register the depths. The deeper casts are obtained by a sounding machine of clever invention, ,which is also operated by steam. Besides the above methods sweeping or dragging with a submerged sentry or signal is often resorted to. A sounding machine developed largely on the St. Lawrence survey has been successfully used and soundings at 180 to 200 fathoms have been secured without difficulty when the speed of the ship was about seven knots.

After the ship sounding comes the deep sea work where great depths are secured at scattered intervals. These soundings are located astronomically by sun or star observations when the ship is too far out to sea for the shore marks to be distinguishable.

The coastline and topographical features for the chart are secured by traversing or the usual surveying methods. On a straight shore expedition triangulation work is done by using the anchored ship as a mark and locating the shore stations by observations or angles to the ship from the shore.

During the progress of the work a sheet or plan is plotted showing all the details secured. This is known as the rough or work sheet. All triangulation and topographical work are first plotted. The soundings as they are obtained are reduced to the datum adopted and also plotted. These depths show the development of the contour of the bottom and reveal the danger spots. With the soundings all plotted the contours, usually the one, three, five, ten and twenty fathoms are carefully drawn. When any irregularities are noted in these depths the spot is carefully examined to verify or eliminate the existence of any danger to the mariner.

After the rough sheet has been prepared a more finished one is accurately made. This is known as the fair sheet. It is an exact facsmilie of the sheet to be published and is sent to the printer to serve as a model to be engraved or photolithographed. The chart is then printed in large quantities and copies can be secured at the Hydrographic Office for the nominal charge of fifteen cents. The different areas charted are also catalogued and this book free of charge is also issued by the Naval Service Department. Another feature of Canadian charts is a special colouring system which more clearly defines depths and channels and also makes the topographical features distinguishable from the water area. Canada's lighting and buoy system, famed as the best in the world, is also incorporated on these charts. Every week the Department of Marines issues free of charge Notice to Mariners, a pamphlet containing information of interest to marines such as changes in positions of lights, the locataion of new lights or buoys, dredging operations, uncharted shoals or reported dangers. Sailing directions are published by the Hydrographic Survey and supplement with every detail the charts issued.

Perhaps the above description of the work in Hydrographic Surveying may be slightly misleading. It is co-ordinated and carried on to secure speedy completeness. The inshore work is generally done in fine weather while the off shore work is done in rougher times when stormy winds are blowing. As its name implies hydrographic work is water or marine surveying and the surveyor has to contend with wind and tides and be thoroughly conversant with tidal information to establish bench marks and datums to determine the reduction necessary to apply to the initial soundings secured. A thorough knowledge of the meteorological effects on tides, wave measurements and currents are also essential. The marine surveyor must also be able to handle boats in any weather and landing on rugged coasts in all kinds of weather is often unenviable task.

Besides the work of charting the shores and delineating our trade routes the Canadian Hydrographic Survey has greatly assisted in locating harbour terminals for railroads. The harbour of Prince Rupert for the Grand Trunk Pacific Railway, the surveys of Hudson bay and straits including Port Nelson and Churchill for the Hudson Bay Railway, and also surveys in James bay for the proposed extension of the Temiskaming and Northern Ontario and other railroads intended to link Montreal with our hinterland may be cited as examples of service rendered by the Hydrographic Survey to Canadian railway development. It is in connection with the James bay survey that special reference will now be made.

There are two ways to reach James Bay. One is through Hudson straits and bay and the other is by the river routes that cross the Transcontinental line of the Canadian National railways. Journey to Cochrane, Ontario, through the clay belt with its wonderful landscape of rivers, lakes, forests, stretches of fertile agricultural country and the great mining districts. From Cochrane you travel east or west and choose at will the river route to James bay. The Abitibi, the Ground Hog and Mattagami, the Missinabie, the Kapuscasing and the Albany rivers are a few of the waterways from which you may choose. These rivers pass through a country that for picturesqueness and scenic beauty is incomparable. The descent from "the Ridge" to the sea level through the densely forested country results in rapids and waterfalls whose rushing foam covered waters apart from picturesqueness will some day undoubtedly turn the wheels of industrial development.

Already the Ontario Government are aware of the possibilities of this region and contracts have been let for the extension of the Temiskaming and Northern Ontario railway from Cochrane to Tin Can Portage, 70 miles distant. The harbours at James bay have been thoroughly investigated by the Hydrographic Survey and engineers of the railway have also explored the territory and reported on the water powers. In view of this exploratory work the Temiskaming and Northern Ontario Commission are proceeding with construction.

To quote a press report of the Chairman, Mr. Lee:

> "The Commission have every faith in the undertaking and the coun-
> "try we are opening, that it will be one of the finest countries on the North
> "American continent. In the whole 70 miles not one yard of rock is
> "encountered and the grades will be at the very most not more than 4/10
> "of one per cent."

The first hydrographic survey in James bay commenced in 1912 when Mr. H. D. Parizeau was sent with a large party to find a suitable locality for a railway terminus. Moose Factory was reached on the 11th of May but the party was unable to proceed to Rupert's House until the 10th of June on account of ice in the river entrance and bay. During this interval the north channel of the Moose river was surveyed for a distance of over five miles down stream. Extensive investigation of Rupert bay was made during the remainder of the season and a suitable site for a railway terminus was found at Point Comfort, Rupert bay.

In 1913 the survey of Rupert bay and river was carried on by the late Mr. P. Jobin. In 1914 this survey was extended to the outer islands and investigation of Snape Point, the northern extreme of Rupert bay, was made for a harbour terminal. In 1915 the survey of the Moose river was carried out to deep water and the outer track or steamer route surveyed during the remainder of the season.

Originally the Christie C. Thomey, a three masted schooner of 136 gross tonnage was chosen for the James bay work. The Thomey was dropped by the C. G. S. Minto on the 5th of August in latitude 66°50″ and longitude 88° 55′ and was icebound until the 22nd of September reaching the survey field at the end of the season. Undoubtedly owing to the fact that this schooner had no auxiliary power and that her draught would have rendered navigation very difficult in the shallow waters of the bay the "Thomey" would never have proved an ideal boat for surveying these waters. However, the supplies and equipment brought in as part of her cargo contributed to the success of the survey in the two succeeding years.

The survey of James bay was therefore made from a two masted schooner, the Annie E. Geele, belonging to the Revillon Freres Trading Company. This boat wos 45 or 50 tons register, 70 feet long, normal draught 8 feet and could be easily towed by the gasoline launch 33 feet long and equipped with a 24-27 H.P. Standard gasoline engine. The greater part of the soundings were done from this launch.

The methods of constructing the charts were identically the same as previously described but the difficulty in securing the soundings was greatly augmented by the lowness of the shore which made it difficult to see the beacons when only a few miles off. The triangulation scheme and shore line were laid down in the usual manner but it was often necessary to drop buoys with flags attached or dories carrying flag signals when the shore stations were becoming indistinct. These marks were fixed by the shore stations and the soundings were then carried out using the buoys to fix by or determine the position of the boat. When these buoys were fading from view other buoys were placed and their positions "fixed" by the previous set.

In other places the shoals, or sandbars, which covered and uncovered, were found useful, for at low water flag poles braced with wire stays could be erected. These afforded a good mark and offered but little surface to the battering waves. When stakes were driven down or anchors placed at the end of the guys the sea seemed to pile the sand around them rather than wash them clear.

Had the work been carried out farther in the bay some other methods would have been adopted. In the Naval Service report of 1913 Captain F. Anderson explained his method of fixing soundings on the Nelson shoals and it is undoubtedly one of the best that can be adopted for such a territory.

> "The method adopted under the above conditions for 'fixing' the "soundings was as follows: The ship being anchored in a convenient "place was fixed by sextant angles taken to shore stations visible and all "buoys possible to see. Taking the ship as a centre radiating lines about "8 or 10 degrees apart were carried from 2 to 3 miles off, thus covering a "circle about 5 miles in diameter at each point.

> "Dories carrying flags were anchored about half a mile from the "ship to give the line, and the launch, when sounding was cut in from "the ship by sextant angles and the distance from the ship obtained by a "ship's masthead angle taken from the launch. A canvas disc, 4 feet "in diameter, painted black, was hoisted to the main mast head, that it "might be easily distinguished at a distance."

By this method from 60 to 70 miles could be sounded on a calm day, the ground being covered quickly and efficiently.

In working in a low country such as that surrounding James bay the surveyor is therefore at a disadvantage. Nor is this lowness the only obstacle encountered. The shoalness and the frequent occurrence of shoal spots make the work difficult but interesting. The ice conditions are such as to retard the work and make the season a short one. The tides also are to be contended with for owing to flatness of the country the shores dry out for miles, especially at the southern end of James bay.

Of course the boat equipment depends on the size of the party. A 20 ton schooner or a larger one of 40 or 50 ton with a normal draught not exceeding 8 feet and a gasoline launch of 25 H.P. can be used in James bay or similar waters, but care would need to be exercised in avoiding heavy storms. Probably the very best boat for such work would be an oak built boat of 70 or 80 tons, about 80 feet long, 7 or 8 feet draught and equipped with a 30 or 40 H.P. engine. Such a boat could carry all the smaller boats necessary for the work and ride out severe storms. The flat bottom dory is unquestionably the best boat for landing on shoal flats such as those encountered in James Bay.

Now I will speak briefly of the country itself for unquestionably in the future—perhaps nearer than we realize—this region is going to be a field of exploration and development for the surveys which we represent. The popular belief that the region north of the Transcontinental line of the Canadian National railways is a wilderness waste will be dissipated and there will be an influx of hardy and prosperous settlers. These settlers will not endure such obstacles to success, as lack of machinery and railway transportation but will receive the encouragement they deserve. Speaking in the House of Commons, April 3, 1906, the late Sir Wilfrid Laurier uttered these prophetic words:

> "It is not enough for us to confine our views to Canada that is not "settled, we must look ahead, we must push northward as far as colonization can go. I have great confidence that before many years are "past we shall see towns and villages on the shores of Hudson's Bay, as we see on the shores of Norway, where people will be prosperously "engaged in the lumbering indusrty, the pulp industry, the fishing "industry, the mining industry and others."

Nor is this a dream that cannot be realized. Time alone is the limiting factor in our northward expansion.

James bay may be considered about 300 miles in length and about one-half as broad. It is therefore larger than Lake Superior. The fisheries have been investigated and it has been stated, based on this investigation, that they are very valuable and that the white fish industry will surpass that of any place in Canada. Its mineral prospects are as yet untouched. Its agricultural possibilities are unquestionable. With these few remarks we must pass on firm in the conviction that our northland is not an interminable wilderness or an illimitable waste but a store-house that is a national asset upon which the country may draw when the process of colonization becomes an expansive one rather than the present settlements along our railway lines.

Reverting to our original subject we may say in conclusion that Hydrographical Surveying is essential to our commercial development and absolutely necessary for the safe navigation of our long coast line. The work is often prosecuted under the most trying and hazardous circumstances and even the splendidly equipped ships furnished by the Government for this service are forced to batter their way through the ice bound straits of Hudson's bay or at verious time have been severely buffeted by the tempestuous seas. Canada is working hard to keep its trade channels well charted, well lighted and buoyed. When ships come to us over the trackless main or leave our ports on their outward bound journey they find our shores as well charted by Canadians as those of any civilized nation.

THE CHAIRMAN: Mr. Bowes' excellent paper and illustrations bring out clearly the methods adopted and the difficulties experienced in northern waters, especially in James Bay in connection with Hydrographical surveying. If there are any questions, Mr. Bowes would be glad to answer them.

MR. NELLES: I would just like to ask if they used the wire drag system in James Bay.

MR. BOWES: The wire drag system was not used in James Bay but the drag system has been used in the Great Lakes, on the Atlantic Coast and also, I believe, on the Pacific Coast.

MR. DODGE: While hydrographic surveying is very closely related to land surveying it is a subject of which most land surveyors know very little, and I am sure we have all enjoyed Mr. Bowes' very excellent review of the general principles of hydrographic surveying and I have much pleasure, Mr. Chairman, in moving a vote of thanks for Mr. Bowes' very instructive paper.

MR. McELHANNEY: I take very much pleasure in seconding that motion.

MR. BOWES: I thank you very much and esteem it an honour to come before you.

THE CHAIRMAN: The next item this morning will be an address on Photographic Surveying, by Mr. Bridgland.

PHOTOGRAPHIC SURVEYING

BY M. P. BRIDGLAND, D.L.S.

In preparing this article, it has been the object of the writer to give a short account of the conditions under which photographic surveys are usually made and a brief description of the field and office work, without any attempt to deal with the subject from a theoretical standpoint. English literature dealing with this class of surveys is scarce and in the majority of recognized text books, if mentioned at all, the chapter devoted to the topic does little more than acknowledge the existence of the photographic system or at best offers a very brief introduction to the subject. Even then there appears to be some difference of opinion as to the utility of the method, probably because the authors have had little or no practical experience with photographic work and are not personally familiar with the conditions, physical or climatic, under which much of the work must be carried on. Nevertheless photographic methods became firmly established a long time ago and afford the most accurate and economical means of mapping certain classes of country.

In actual work the photographs are really perspectives and from these the map is constructed. The principles involved were first suggested by J. H. Lambert of Zurich, 1759, but no effort to apply them practically was made until 1791-3, when Beautemps Beaupre' made the first attempt, using a series of freehand sketches of the coast region of Tasmania and Santa Cruz island. Although himself convinced of the feasibility of the system, he failed to convince others, probably on account of the difficulty of making freehand drawings sufficiently accurate for the purpose, and so the method was practically forgotten.

In 1839, Arago called attention to the possibilities of utilizing photography and in 1849 Captain Leblanc made an attempt to apply it to French military surveys. All early attempts were much hampered by the slowness and uncertainty of the early photographic process, and by the heavy and cumbersome apparatus required. In 1850 Col. A. Laussedat (who was practically the father of photographic surveying) began a study of the subject using at first a "camera clara" for obtaining the necessary perspectives, tracing the outlines by hand. For some years he continued this work, improving the instruments and elaborating the methods, and when a suitable lens was obtained, substituted photographs in place of freehand drawings. In 1859 he felt justified in announcing his success to the Academy of Sciences in Paris, and after a careful and critical examination, a favourable report was made, and photographic surveying passed from the experimental stage and became a recognized science. Since that time it has made rapid strides and has been used extensively in many European countries and also in many other parts of the world.

The introduction of photographic surveying into Canada was due to Dr. E. Deville, Surveyor General of Dominion Lands, a man of high scientific attainments. He was quick to realize its value for mapping the extensive mountain regions of Western Canada and himself designed instruments which he considered specially suitable for the requirements. These instruments are still in use, almost in their original form, though minor alterations have been made and modern lenses have replaced those originally used in the cameras. In addition he wrote an exhaustive treatise entitled "Photographic Surveying" dealing with the subject from both a theoretical and a practical standpoint. Unfortunately only a limited edition was published and the book has been out of print for many years. In 1886, Mr. J. J. McArthur, D.T.S., with a small party, was sent out to commence a topographic survey of that part of the Rocky Mountains adjacent to the Canadian Pacific Railway. This work was continued for about seven years and although largely experimental in its early stages, was very successful and Mr. McArthur was able to map an area of about 2000 square miles using a scale of 1/20,000 and a contour interval of 100 feet. Since that time many other extensive surveys of a like nature have been made in Canada by the Surveyor General's Branch and also by other Government Departments.

Photographic methods are not applicable to every class of country. It is necessary that there should be bare summits suitable for stations, and that there should be sufficient relief to permit the ready identification of the same points on views from different stations. Consequently the camera cannot be used in districts where all the hills are heavily timbered. Considerable work has been done in foot-hill districts where occasional bare points can be found, and where views in one or more directions can be obtained by partially clearing off other summits occupied. Owing to the difficulty, often impossibility, of getting stations where most needed and the absence of pronounced topography, the results are not entirely satisfactory. Still a very fair map may be made showing all the main features and much of the detail, and when criticising, it should be remembered that it is a difficult and expensive matter to accurately map country of this nature by any other method. It is, however, in the higher mountain ranges that the camera can be used to the greatest advantage. Here there is no difficulty in obtaining stations and the mountains with their bold rugged outlines afford much better photographic subjects than the rolling foothills. In addition to this, mountain views usually cover a greater area and the identification of points may be accomplished much more rapidly and accurately than when dealing with less broken country.

On Canadian photographic surveys the essential instruments are a small transit and a camera. These instruments are of the smallest possible form so that there may be no complicated adjustments to get out of order.

The transit is a light instrument of the ordinary pattern made by Troughton and Simms, London, with three inch circles reading to minutes. The tripod has extension legs, three feet four inches long when extended and twenty inches long when closed. When in use, a bag is suspended between the legs, and filled with stones, and then the legs and bag are blocked with more stones so that the tripod may be rigid in any wind. For packing, the tripod head is taken off and placed in the transit box, and the legs are placed in the back of a canvas designed to hold both the box and the legs. This case is fitted with shoulder straps for carrying and with the instrument and tripod weighs about fifteen pounds.

The camera consists of an oblong metal box open at one end and fitted into a strong outer wooden case made of mahogany. The metal box carries the lens and two sets of cross-levels which may be read through openings in the outer case. Inside the metal box there are two sets of diaphragms to intercept any light which does not contribute directly to the formation of the image, the whole interior is blackened and as a further precaution, a shade is placed over the lens when exposing a plate. The back of the outer case is movable and is so arranged that when a plate is inserted in the camera it can be screwed in against the holder so that the plate is firmly held against the open end of the inner box, thus insuring that the plate is always in the same position relative to the lens. The instrument stands on a three screw base similar to that of the transit, so that both instruments may be used on the same tripod. The camera may be used with the long side either horizontal or vertical. In the horizontal position the lens has a field of about fifty-one degrees and in the vertical position a field of about thirty-seven degrees, the extent in either position being shown approximately by lines ruled on the case. The size of the plate is 4¾ x 6½ inches. The carrying case is designed to hold the camera and twelve single plate holders and is fitted with shoulder straps. The total weight of the case with the camera and twelve plates is about twenty pounds.

In order to use the camera certain conditions are necessary. The plates, while being exposed, must be in a vertical plane, the position of the horizon and principal lines must be known and also the focal length of the lens. While these determinations may be made separately and by different methods, the writer has found it advantageous to make all of them at the same time, and to always make measurements by which the focal length of the lens may be computed, even though using the same lens year by year. This means little extra work and affords an independent method of checking the focal length of the enlargements used in plotting as the contraction or expansion may vary in different lots of paper.

To make these tests, a place is selected where several points of about the same elevation may be found. This is usually a level meadow or a small valley. The camera is set up in a horizontal position and a level or transit placed a short distance away, so that the telescope of the latter is on the same level as the centre of the lens. Figure 1 shows the transit placed in position. Then some distance away three targets A, B & C are placed on the same level and in such position that the two outside ones, A & C will be just inside the field of the camera when horizontal and A & B just inside the field when in the vertical position. A specially prepared mirror, long enough that the end projects about four inches beyond the camera, is then inserted and screwed

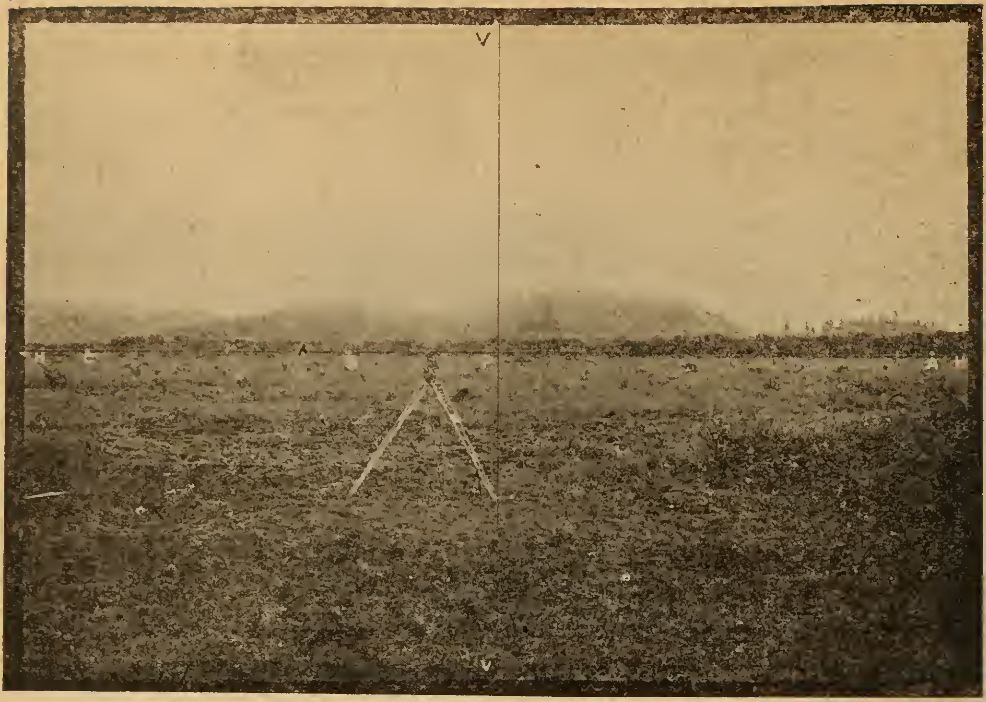


Figure 1.

up firmly against the inside case in the exact position occupied by the plate. The camera is turned until the reflection of one of the signals can be seen through the telescope and it is then tilted forward or backward by means of the foot screws until the horizontal hair of the telescope bisects the image of the target, the transverse level being kept in its centre position throughout. The mirror is then in a vertical plane and the position of the bubble parallel to the axis of the camera is carefully noted. The mirror is removed, and with the camera very carefully levelled, one or more views are taken showing the transit and the three signals. After this the camera is set up in its vertical position and the mirror replaced. By shortening the legs of the tripod, the camera is lowered until the mirror shows above when viewed through the telescope and the position of the other bubble when the plate is vertical is found as before. When this is completed the mirror is removed and the camera raised until the lens is again level with the telescope, and other plates are exposed in the vertical position showing the signals A and B.

For the determination of the focal length, the transit is then moved to the position occupied by the camera and the angles subtended by the three signals are carefully read.

In making use of this information, the plate itself may be taken or the plotting enlargement. In either case the procedure is practically the same, but it is easier to work on the enlargement and that is really of more vital importance to the topographer than the negative. If several enlargements be used they will give practically the focal length for use in plotting as the contraction is not likely to vary much with the same lot of paper. This, however, cannot be taken for granted and the dimensions of the enlargements must be carefully watched.

It is now necessary to determine the horizon and principal lines. On one of the horizontal views draw carefully a fine line through the centre of the targets A, B and C (Figure 1) and then do the same on one of the vertical views. These lines represent the horizon lines for their respective views. Take the horizontal view and by means of the notches VV transfer the line from the vertical view and find P, the intersection of the two lines. This is the principal point of the view. Through P draw a line VV perpendicular to the horizon line. This represents the principal line of the view and if all levels are in proper adjustment, should coincide with the vertical line as transferred from the second, though this condition is by no means necessary. The vertical view is then treated in a similar way.

To determine the focal length the distance from the signals A and C to the principal point P must be very carefully measured. The focal length is then found as follows:—

Let the distances A to P and C to P (Figure 2) be a and b respectively. Let PF represent the focal length f and let m and n be the angles AFP and CFP and let $m + n = s$. All these are known angles, measured in the field.

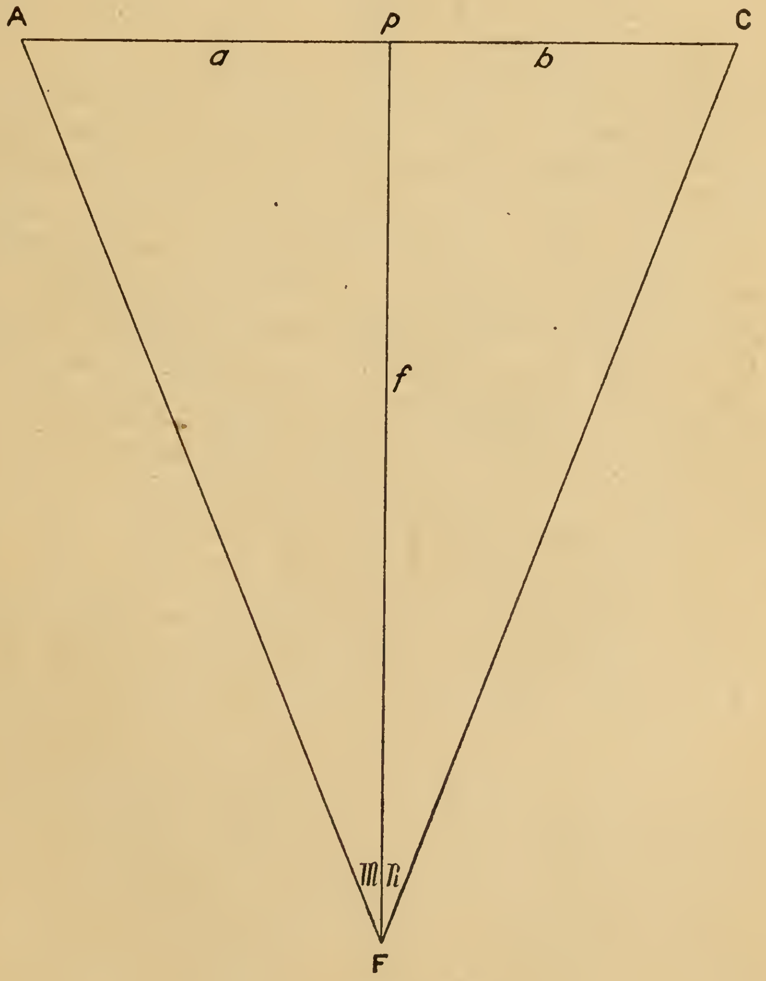


Figure 2.

$$\text{Then } \tan m = \frac{a}{f}$$

$$\tan n = \frac{b}{f}$$

$$\tan m \tan n = \frac{ab}{f^2}$$

$$\tan (m + n) = \tan s = \frac{\frac{a}{f} + \frac{b}{f}}{1 - \frac{ab}{f^2}}$$

From this we have a simple quadratic equation

$$f^2 - \frac{a+b}{\tan s} f - ab = 0$$

which when solved gives

$$f = \frac{a+b}{2 \tan s} + \sqrt{\frac{(a+b)^2}{4 \tan^2 s} + a\,b}$$

Determinations of the focal length should be made for both positions of the camera as the contraction of the paper in different directions may vary.

Photography in Alpine districts, particularly in the higher ranges, present many difficulties. There are snow peaks glistening in the sunlight and deep heavily timbered valleys partly in shadow and often filled with a bluish haze due to atmospheric absorption and diffusion of light. Moreover the diffusion of light causes the more distant points to become indistinct, the landscape gradually merging into a uniform tint, an effect known as "aerial perspective". Now survey photographs must be clear and full of detail so that the points to be plotted may be well defined and easily identified. Hence to obtain satisfactory views, it is necessary to use plates which have great latitude of exposure and which give, as far as possible, a correct rendering in monochrome of all different colors. The plate used for some years on Canadian Topographical surveys is the Wratten and Wainwright Panchromatic plate which is used with a yellow screen made by the same company, and known as a "G" filter. This make of plate is sensitive to all rays of light and when used with the screen, which reduces the effect of the more actinic part of the spectrum, i.e. the ultra violet to blue rays, has given excellent results. To prevent halation, or diffusion of light from the back of the glass, the back of the plate was formerly covered with a black substance in optical contact with the glass, but during the last season a double emulsion has been used instead. This means that the sensitized film is of sufficient density to absorb all light falling upon it during exposure and to prevent any light penetrating to the surface of the glass. Owing to their extreme sensitiveness, these plates must be handled in the dark not only in the field but also in the developing room. Because of this, there is no opportunity for controlling the development and the matter of correct and uniform exposure becomes an extremely important factor.

There are many difficulties encountered in the field, among the first of which are those involved in climbing. On the lower slopes there is dense underbrush and windfall to struggle through, and higher up snow slopes and glaciers to cross, rock cliffs to climb and difficult aretes to traverse. On the summit the surveyor must work with an instrument set up on a pile of loose rock on the most exposed part of the peak, frequently suffering severely from cold and wind while doing so. These, however, are minor difficulties and not nearly so serious as those due to variations of light and sudden changes of weather. The surveyor cannot wait indefinitely for a suitable light but must use his own judgment regarding exposure. This is a difficult matter when cloud shadows are heavy, particularly in a country where there is but little contrast. Even on a fine day, some views may require three to four times as much exposure as others. Often it is necessary to work rapidly in order to get through before an approaching storm breaks, or before clouds roll over the peaks and render further work impossible. Other causes of much trouble, particularly during the latter part of the season, are smoke from forest fires, dense haze and early snow storms. In these circumstances the surveyor must decide under what conditions he can work profitably and this depends very largely on the nature of the district. In Alpine country or where valleys are narrow, serviceable views may be obtained under very unfavourable circumstances, but in rolling country or where great distances are involved, objects soon lose their distinctness. Good photographs can be obtained only under favourable circumstances but much of a surveyor's success depends on his ability to get serviceable photographs under varying adverse conditions.

When in the field it is important to select those points which give the best views of the surrounding country. This does not mean that the highest peaks are always the best. In photographs taken from very high peaks the surrounding country often appears dwarfed and the detail does not show up so well as in those taken from a more moderate elevation. It must also be remembered that the higher the peak the longer the ascent will require, and the greater the liklihood of encountering sudden storms or floating clouds. Frequently very useful views may be quite easily obtained, from points of comparatively low altitude.

It is customary to take enough views from each peak to cover the complete circuit of the horizon. This means very little more work for the surveyor in the field and the extra views are often of assistance in the office. It seldom happens that all the views can be taken from a single point, and usually one or more camera stations are required on different parts of the peak. As a rule these stations may be located by reading angles on them from the main station and measuring the distance with a light tape. Angles must be read on at least one well defined point in each view, preferably on two. The angle of elevation or depression should also be read on each point as it may serve to check the horizon line of the view, if there should be any trouble in the office. It must be remembered constantly, throughout all field work, that the country to be mapped must be seen from at least two points which subtend angles great enough to give satisfactory intersections, and not too great to permit easy recognition of the same points as they appear in corresponding photographs, taken in pairs, one from each station.

For plotting purposes, bromide enlargements approximately 10 x 14 inches in size, are made from the negatives. To obtain satisfactory results, the enlarging must be accurately and uniformly done. This work is done by the Department at Ottawa with an enlarging camera constructed specially for the purpose.

In the office, the triangulation is plotted by ordinary methods depending on the nature of the control. This may vary from a precise triangulation to a reconnaissance survey where the triangulation and the photography are carried on at the same time. The elevations of the stations and more prominent peaks are computed from the angles read in the field, the necessary corrections being made for curvature and refraction.

Views from different stations, showing the same country, are then selected. Sufficient points are identified on the corresponding views to show clearly the topography of the country. These points are plotted on the plan and their elevations calculated from the photographs. Using these points as a guide and with the photographs in front of him, the topographer is able to draw his contours with an accuracy dependent chiefly on the number of points plotted and the scale of his plan.

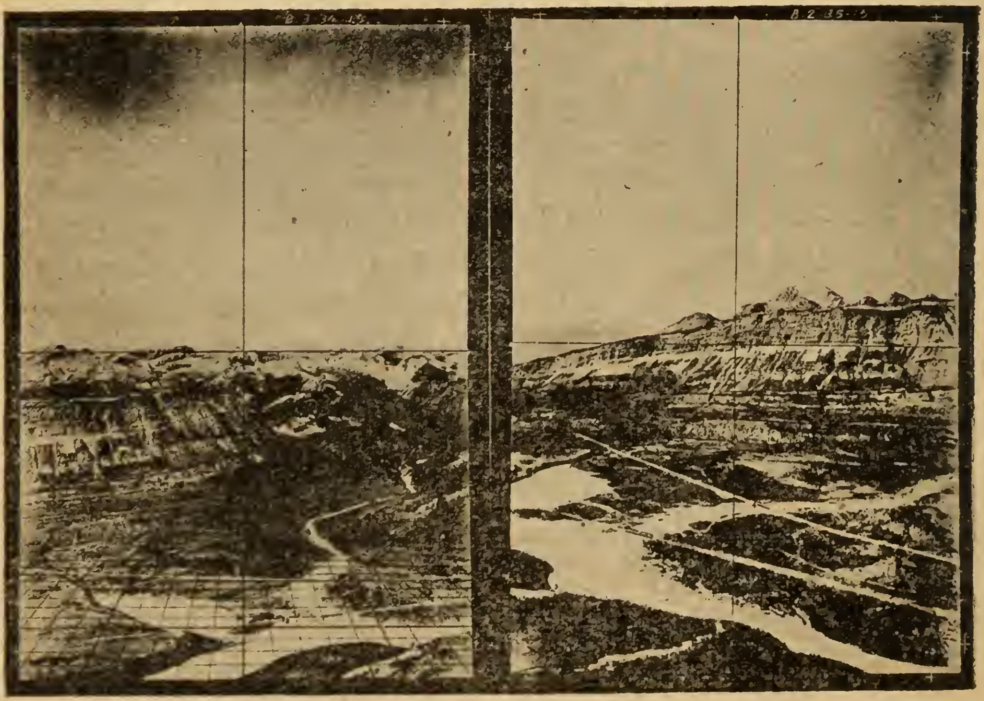


Figure 3.

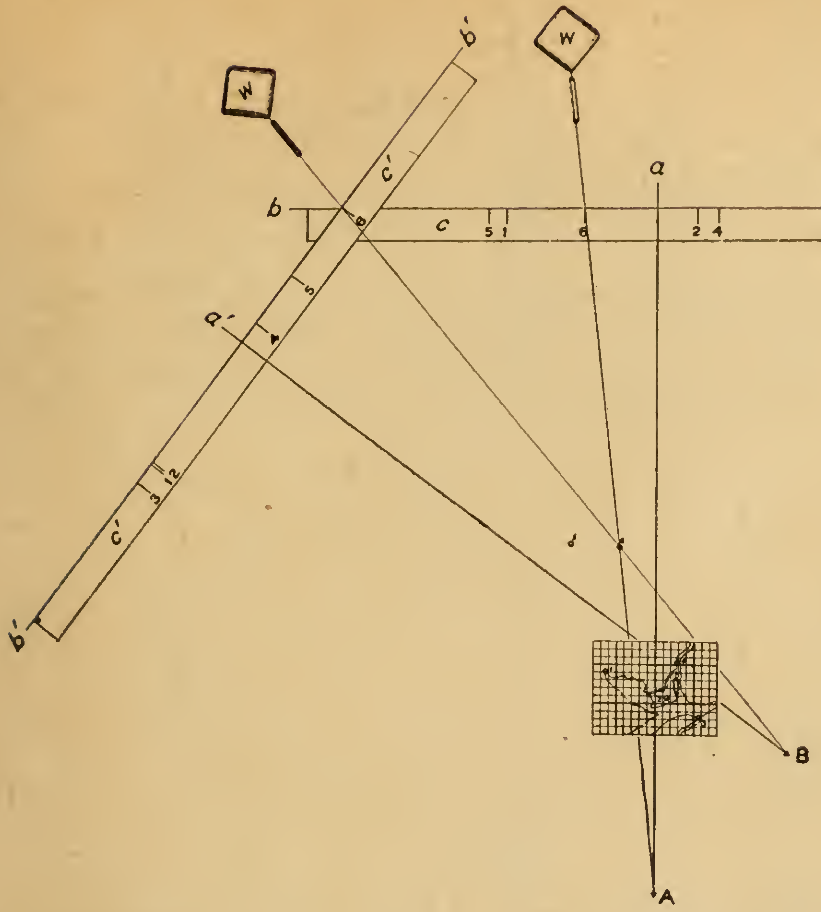


Figure 4.

Figure 3 represents views from different stations shown as A and B on Figure 4. On these view points 1 to 6 have been identified to show the method used in plotting. The horizon and principal lines are ruled on the views in their proper positions as shown by the test views. The traces of the principal lines and the picture plane then laid down as shown in Figure 4. The lines from the stations A and B to a and a' represents the principal lines of the views and b b and b' b' represent their respective traces. The distances of the points identified from the principal line are then taken off on a slip of paper, using a separate slip for each view. These slips c c and c' c' are placed on the proper traces as shown in the illustration. The line of sight to any point is given by the intersection of two or more of these lines of sight. Instead of drawing lines on the plan, it is customary to insert needles at the stations and to determine the intersections by means of fine threads or hairs attached to small weights. In Figure 4 these weights are represented by w, w, and the hairs are shown intersecting at the point 6.

The geometric construction for laying down the traces is as follows:—

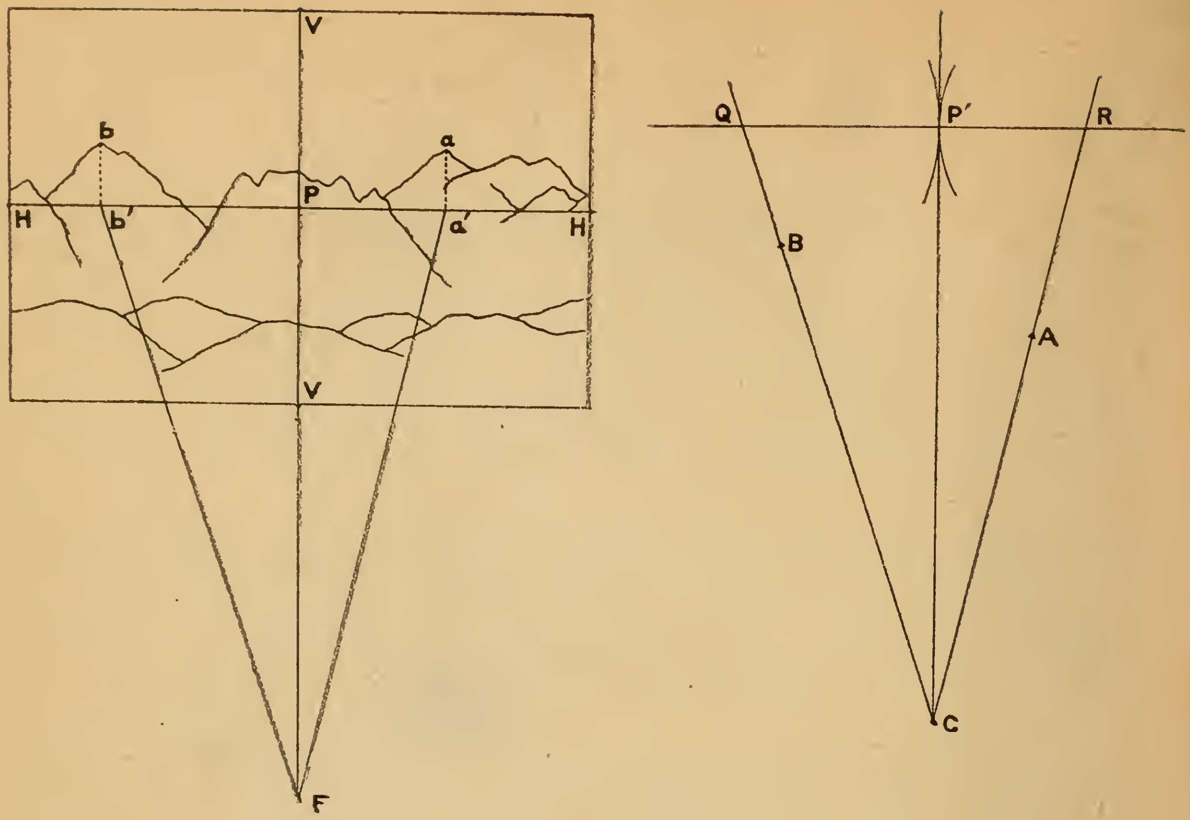


Figure 5.

Let *a* and *b*, Figure 5, represent two known points either triangulation stations or points to which angles have been read by the transit. Produce the principal line VV to F making P F equal to the focal length. Find the projections *a′* and *b′* of *a* and *b* on the horizon line and measure the distances F *a′* and *f b′*.

In the second part of the diagram, C represents on the plan the station from which the view is taken and A and B the two points. Draw lines from C through A and B and make C R and C Q equal to F and *a′ and F b′* respectively. With R and Q as centres and radii P *a′* and P *b′* respectively, describe arcs of circles as shown. Draw C P′ and join Q R. Then P′ is the projection of the principal point and Q R is the trace of the picture plane. If there is an inaccuracy in the location of the stations or in the other work the two arcs will not be tangent to each other and the mean position will have to be used.

In order to facilitate the laying down of traces several methods have been devised. One of the best of these methods is due to Mr. R. D. McCaw of British Columbia. In this method a piece of celluloid is cut as shown in Figure 6 and two lines TT and FY drawn at right angles, PF being made approximately equal to the focal length. A small slot is cut at F and a scale ruled to cover variations in the focal length. The instrument is placed on the view and the distances of the points as *a* and *b* Figure 5 from the principal line marked on the line TT with ink. The instrument is then transferred to the plan and using the proper focal length as shown by the scale it is rotated around C, until the points marked, which correspond to *a′* and *b′*, fall in Q and R. The position of the principal line is pricked through by means of the holes shown at O P and Y and the position of the trace by means of those at T T or in the case of a vertical view of those shown a little nearer the centre. The temporary marks are then cleaned off with a damp cloth. It will be readily seen that this method corresponds with the one given previously.

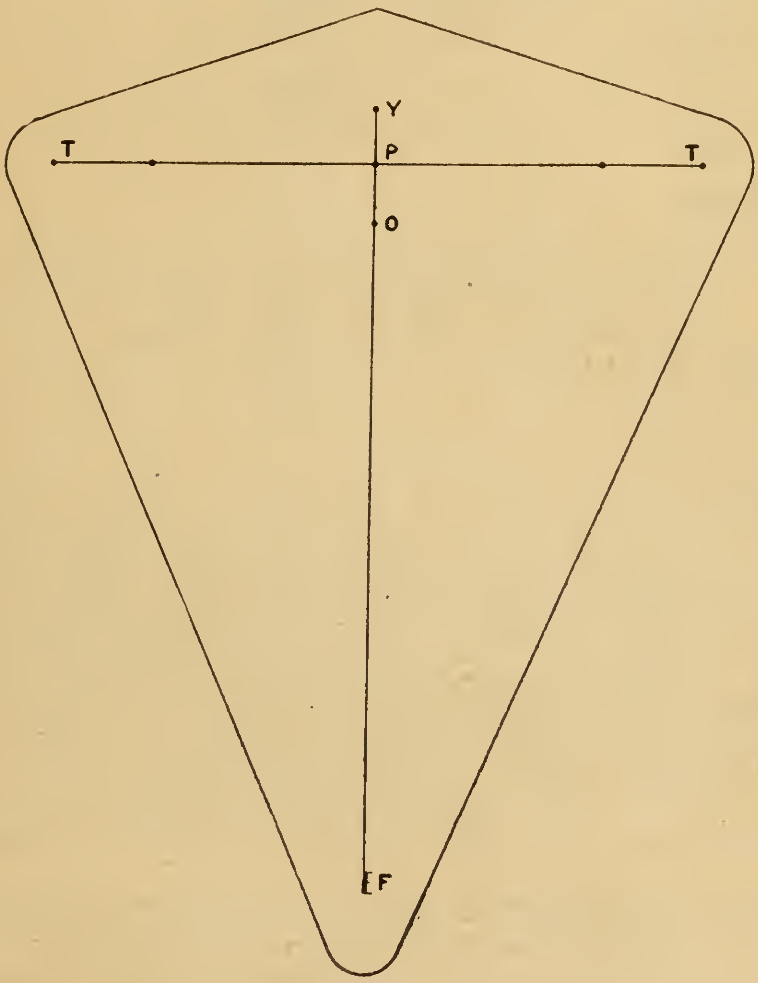


Figure 6.

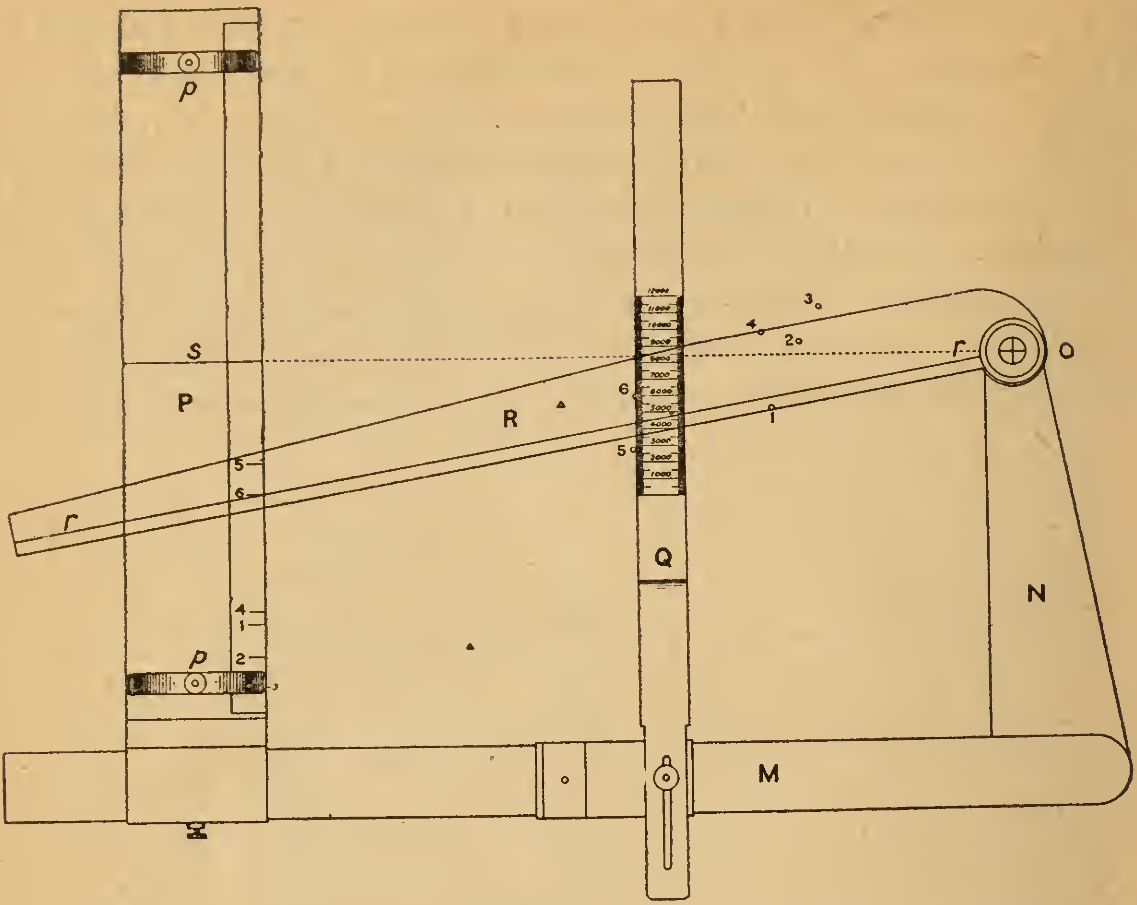


Figure 7.

The elevataions of the points are determined by means of the instrument shown on Figure 7, which was originally devised by Messrs. D. B. Dowling and H. Matheson of the Canadian Geological Survey. The arms M and N are of brass fastened rigidly together. P and Q are sliding bars moving on the arm M. R is a swinging arm revolving around the centre O; P and R are made of transparent celluloid and on R a fine line *rr* is ruled radiating from the centre O. The arm Q carries a scale corresponding to the scale of the map. The instrucment must be made accurately so that when the line *rr* is over the line s, the reading of the scale will be constant when moved along the arm M.

When using the instrument the centre O is placed over the station, and the arm P, is placed so that the one edge coincides with the trace of the view, the lines falling on the principal line. The instrument is then held in place by heavy paper weights. The distances of the points above or below the horizon line as shown on the views is taken off on a slip of paper. The slip is placed on the arm P as shown in the diagram anad held in position by the clips *p p*. The scale is now set to read the elevation of the station when the line *rr* is above *s*. To obtain the elevation of the point 6, the arm Q is moved to the point plotted and the arm R moved so that *r r* passes through 6 as shown on the slip. The elevation of the point is now given by the reading of the scale where it is intersected by *r r*. To avoid mistakes the elevation of each point is taken from two views and the mean of these two elevataions is used.

Relatively level features such as swamps, lakes or rivers with comparatively small fall are plotted by means of squares. The perspective of a series of squares is laid down on the view and the projection, on the proper scale, is drawn on the plan. Then from the view the required features are drawn on the projection, square by square, as carefully as possible. It is necessary that the squares should be small enough to give good definition. In practice these squares are not ruled on the views but an instrument called the perspectometer is used instead. This consists of the perspective of a series of squares ruled in glass, having the distance line equal to the focal length of the photograph. It is customary to make the sides of the squares equal to one tenth of the difference in altitude between the station and the features to be mapped, though this may be varied to suit the circumstances. The instrument is placed in its proper position on the view and the features drawn as before. The perspective of a set of squares is shown on the first view of Figure 3, and their projection, with the topography drawn in is shown in Figure 4.

The accuracy of a photographic map depends first of all on the precision of the triangulation system controlling the survey. After that it is dependent on the number of camera stations and on the scale of the plan. Any scale or contour interval of 100 feet and a scale of 1:40,000 very convenient for a large plan. The precision is that of a good plane table survey but with the advantage that many more points are plotted and the contouring is done by the surveyor in the office, with views from different stations continually before him, while with a plane table this comparison is entirely wanting.

The most tedious and tiresome part of the work is plotting the points and drawing the contours. The office work requires at least twice as long as the field work. However, the time required for the field work which is the most expensive, is much less than if any other method of survey were employed and consequently delays due to adverse conditions are reduced to a minimum. The office work is carried on by a small staff and under favourable conditions, and is not so subject to unexpected interruptions.

A party of seven can work to good advantage under most circumstances. The party consists of the surveyor, his assistant and five men, two of whom should be expert packers, if pack horses are used. With two sets of instruments, the surveyor and assistant surveyor, each accompanied by two men are free to work in different localities, the cook being left in charge of main camp at some central point. Except on long or dangerous trips one man is enough to accompany the surveyor when actually climbing. If in a country unusually difficult of access, extra help may be necessary, and even under ordinary circumstances an extra man is often an advantage.

With regard to the future of photographic surveying, it is probable that owing to the nature of the country to which it is applicable, the demand for work of this kind will always be rather limited. There are very large mountainous areas in Alberta and British Columbia which can be satisfacorily mapped in this way and other less broken areas, some partially timbered, which may be mapped by the camera alone or by the camera used in conjunction with other methods. While this class of country will not develop with a rush, as the prairie did a few years ago, its development will be gradual and there will be an increasing demand for topographic maps until ultimately it will all have to be surveyed. So far the work has been confined to government surveys of large areas on a small scale, but it is probable that as the method becomes better known, it may be found a rapid anad accurate means of obtaining the topography of small broken sections on a large scale. Should such be the case, its field of usefulness would be greatly extended.

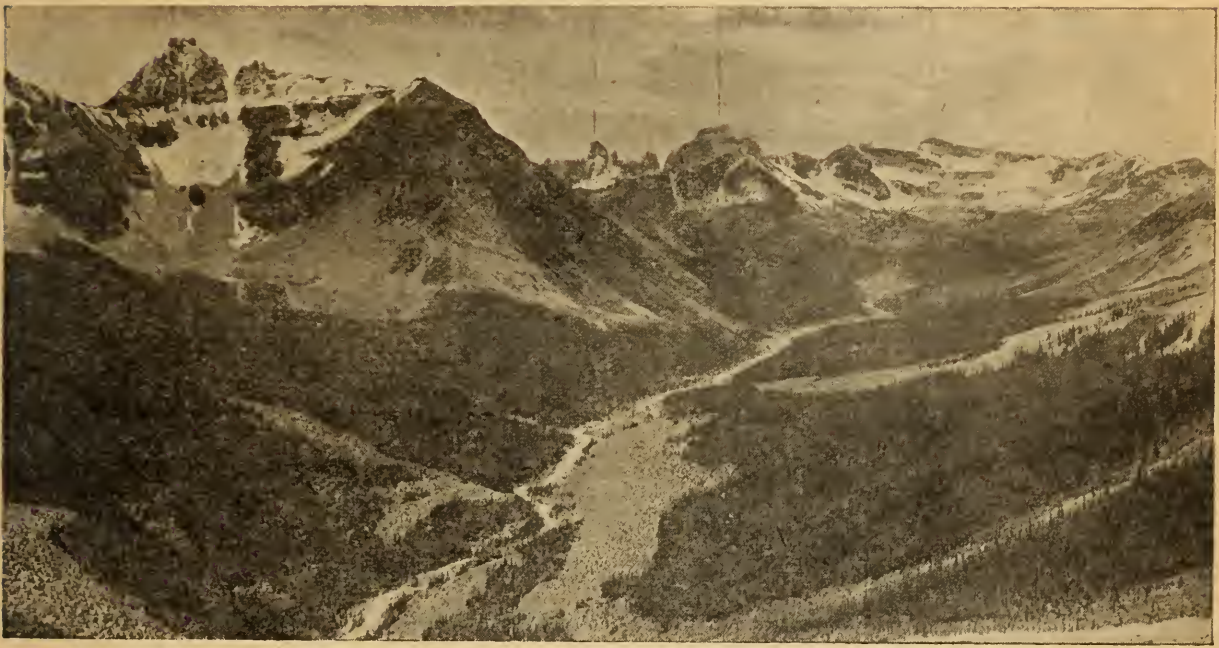
A number of excellent photographic views were here thrown on the slide, illustrating mountain scenery. A few of these are distributed through this report.

THE CHAIRMAN: Mr. Bridgland in his comprehensive paper explains clearly the instruments used in phototopographic surveys and the methods adopted in plotting certain kinds of country. The views were also particularly good. As Mr. Bridgland points out, Dr. Deville is recognized as an authority on this subject not only in this country but wherever photographic surveys are carried on, and we would very glad to hear from Dr. Deville on this subject.

DR. DEVILLE: Mr. Bridgland has had a great many years' experience in photographic surveying: that he should have presented a very excellent paper is no more than was to be expected. The beautiful views which he has thrown on the screen show his great skill in photography. It may be mentioned that in the book issued by the Kodak Company to describe the use of panchromatic plates, the illustrations were selected from among Mr. Bridlgand's photographs. (Applause).

MR. NELLES: I have listened to Mr. Bridgland's paper with much interest and I am sure we have all been delighted by the beautiful pictures we have seen. I was much interested in the plotting machine for elevations which Mr. Bridgland showed us. While we have not used that particular style in our work on the Boundary survey, I think if I am not mistaken, the credit for devising this machine belongs to Mr. Boyd. He invented one in 1905-06. Mr. Craig and myself were invited over to see the first one, made out of a soap box. I would like to second Dr. Deville's vote of thanks for Mr. Bridgland's interesting address and pictures. (Applause.)

THE CHAIRMAN: I have much pleasure in extending to Mr. Bridgland the thanks of the Association for his instructive paper and slides. (Applause).



CLAIRVAUX VALLEY FROM MT. KATAKA

THURSDAY AFTERNOON SESSION.

THE CHAIRMAN: I recognize that it is impossible to convey fully to one who has not made the trip the experiences that go to make up such an expedition but I am sure that after Mr. Seibert has handled the subject you will be able to follow with much more interest any development that may take place in the far north.

MACKENZIE RIVER SURVEYS, 1921.

(Illustrated)

By FRED. V. SEIBERT, D.L.S.

The Mackenzie River surveys of 1921 were one of the many interesting activities of Dominion Land surveyors during the past season.

Slides to be shown this afternoon are views of characteristic features of the Mackenzie river and Norman oil fields including a photographic record of the trip from Peace River to Norman by scow, a distance of 1400 miles. As these views are comprehensive in their scope and give a fairly complete photographic record of area covered, a few preliminary remarks will suffice.

Of the early history of the Mackenzie district we will say but little. Among those most prominent in its exploration were Samuel Hearne 1770-2, Alexander Mackenzie 1789-92, John Franklin 1820-1 and 1825-6, John Richardson, George Back, Kendall, Thomas Simpson, Peter Warren Dease, Anderson, Stewart, Roderick MacFarlane, Emile Petitot, Warburton Pike and David T. Hanbury. In 1887-8 R. G. McConnell of the Geological Survey of Canada carried on the first extensive geological investigation in this district. It is interesting to note that he pointed out at that time, over thirty-three years ago, the oil possibilities of the Mackenzie river valley. He stated that the possible oil-bearing rock along the Mackenzie river valley is almost co-extensive with the valley itself.

All of the early surveys were track surveys with control observations for latitude at widely separate points. In 1888 Wm. Ogilvie of the Topographical Surveys Branch, Department of the Interior, made the first and only extensive instrumental survey in this district up to last year. His survey was made with the aid of a transit micrometer, stations being taken from point to point along the river. The intervening shore line, islands and opposite banks were sketched and occasionally prominent points were located by intersection bearings.

The recent efforts that have been made to ascertain and develop the oil resources of the Mackenzie river valley have aroused a new interest in this district. This increased interest with its resultant stimulation to development has created a keen demand for more complete information. The investigations carried on by the geologists employed by the Department of Mines and by private enterprise, and the extensive staking out of areas for oil and mineral development have made more accurate maps of this district essential.

The first important demand for a survey came from the Department of Mines. A contract was made with that Department by the Topographical Surveys Branch to survey the Mackenzie river shore line including both banks and all islands from Great Slave lake to Norman, to furnish plots of the traverse as the work progressed to the geologists in the field and to deliver final plans to that Department by December 31st, 1921. In accordance with the best traditions of Dominion Land Surveyors the contract was not only carried out but a great deal more was accomplished. Plots were furnished the geologists in the field and the completed plans were delivered to the Department of Mines on December 31st. In addition the Slave river, the south shore of Great Slave lake, the north shore as far east as Windy Point, the Mackenzie river below Norman for a distance of 105 miles, and Great Bear river for a distance of about half way to Great Bear lake were traversed. In all over 4,000 miles of shore line were surveyed, as great a distance as from Halifax to Vancouver.

Three parties under G. H. Blanchet, D.L.S., E. P. Bowman, D.L.S., and W. H. Norrish, D.L.S., carried on these surveys. Each party consisted of a Chief of Party, two Dominion Land Surveyor Assistants, one range finder man, two rodmen, four canoe men, one draftsman and one cook.

Control stadia traverse methods were employed throughout. Dominion land survey monuments were planted at intervals of from two to five miles on both banks. These were staggered so that they were rarely more than three miles apart. They were placed so as to be intervisible and the bearings of the courses between them were accurately determined. It is intended that the bearings of these courses shall control the bearings of all surveys of oil and mineral claims in the vicinity.

As the control for the surveys which extended throughout an area of over 1,000 miles in length, observations for latitude and longitude were made by the Dominion Observatory Branch at Resolution, Providence, Simpson and Norman. Latitude was determined with the aid of the zenith telescope. In the determination of longitude local time was observed by the meridian transit. Time comparisons were made by the aid of a portable wireless receiving set which was able to receive daily time signals from the station at Annapolis, Maryland, U.S.A. These signals were also received daily by the Observatory at Ottawa and a direct comparison was thus made with Ottawa. Other stations heard regularly during the season and generally more distinct than Annapolis were San Francisco, San Diego, Honolulu, and occasionally a station in Japan and one in the Phillipines. Considerable news items of interest were received from these various stations. Some difficulty was experienced in obtaining these observations during June and the early part of July owing to the long period of day light which limited the time for star observations. Very satisfactory closings were made on these control points by the survey.

The programme of survey work carried on this year included as an essential feature the extension of the Dominion Land system of survey into this district. The most northerly point hitherto reached by the system and the one that was nearest to the Mackenzie river was the northerly end of the sixth meridian at the north boundary of Aberta, latitude 60 degrees, longitude 118 degrees. The end of this line was in a country through which it was impracticable to carry on a production without first having supplies placed at convenient intervals during the winter months by the use of dog teams. As this could not be done before the winter of 1921-2 it was not feasible to commence the survey of the Mackenzie river at this point. The work was therefore carried forward from the thirtieth base line on the Slave river. Plans, however, were made for the production of the sixth meridian during the season of 1922. A trip by Mr. Seibert was made from Providence to the end of the sixth meridian during the summer of 1921 and points were located for the placing of supplies the following winter to be used during the production of the line in the summer of 1922.

In addition to the traverse of the shore line and the establishing of monuments, a great deal of additional work was carried on and information obtained that is of immediate practical value. Soundings with investigations of the boat channels were made. Buoys were placed in the more difficult parts to navigate of the Slave and Mackenzie rivers and in the harbours of Great Slave lake. The locations of oil and mineral claim posts were determined whenever possible. Measurements of the flow of the more important streams were made. Magnetic observations were taken and meteorological data secured. The topography back from the river wherever possible was recorded and the more prominent peaks of the mountains visible from the river were located by triangulation. Observations were made of the natural resources of the district.

The route by way of Fort St. John on the Peace river overland to the head water of the Nelson river and by way of the Nelson and Liard rivers to the Mackenzie river was investigated by A. M. Narraway, Controller of Surveys. It was found to be suitable for early spring traffic. Those using this route will be able to arrive on the Mackenzie river about six weeks earlier than by the regular route. This is due to the fact that the Nelson, Liard and Mackenzie rivers usually open up about six weeks earlier than does Great Slave lake along the regular route.

The transport of these parties to their work is worthy of separate mention. The most northerly point of the work was 1,500 miles by water from the town of Peace River. This entire distance was covered by scow with the assistance of light motor canoes with 6 H.P. gasoline engines.

One of the outstanding features of the transport arrangements as carried out in this district was the co-operation of practically all the Government survey parties. Among these were three parties from the Topographical Surveys Branch, one party from the Dominion Observatory Branch, one party from the Dominion Waterpowers Branch, one party from the Northwest Territories Branch and three parties of the Geological Survey.

This co-operation resulted in a large saving in the expense of transport, the cost being $5000 less than would have been incurred had other methods been used. These parties were also able to take advantage of a particularly early spring break-up and arrived on the Mackenzie river two weeks in advance of the regular steamboats. They crossed Slave lake on June 11th, the earliest crossing of any scow or steamer transport on record.

The views shown were taken by the various surveyors employed on this work and gave a fairly complete photographic record of the trip from Peace River to Norman and return to McMurray.

MR. AKINS: I enjoyed very much Mr. Seibert's talk in regard to the transportation work in the Mackenzie district. There is one thing, however, which I think Mr. Seibert passed over very lightly and I think very modestly, and that was finding the end of the line so easily, within a radius of 60 miles. I would like him to tell us a little more about how he so luckily hit the end of that line. It is a mark of rather exceptional bushmanship to find that so easily.

MR. SEIBERT: Mr. Chairman, I only want to say that what actually happened on that trip was largely "good luck". Our guiding star must have with us. When we got within four miles of what we estimated was the latitude of the end of the line we climbed a jackpine tree and there was the end of the meridian staring us in the face about four miles away.

Of course we had our starting point, Providence, well established both in latitude and longitude and assuming that the end of the sixth meridian had not moved since Mr. Akins established it in 1915 it was then only a matter of travelling from one point of known geographical position to another point whose position was also known. The end of the sixth meridian is 92 miles south and 11 miles west of Providence. The route we followed was 135 miles in length, about 100 miles of which was by water up the winding Beaver river and across the two lakes which this river drains. Throughout our trip we made a track survey of our route and kept it plotted up to date whenever we stopped. Our bearings were determined by pocket compass and our distances were estimated. Any accuracy in our record of this route was largely due to Mr. M. G. Cameron's excellent ability to judge distances. A glance at our sketch of the circuitous route followed by us will show that after all luck, the best of luck, was with us. We could not hope to repeat once in a thousand times.

MR. NARRAWAY: I appreciate Mr. Akins' remark about the bushmanship of Mr. Seibert. That may have been an accident, but I think a great deal of credit is due to the man. Mr. Seibtrt has referred in his talk to the saving of $5000.00 by using the barges for transport. The credit for that and also for the creditable showing made in speed, being the first trip by this system, is due largely to Mr. Seibert's leadership and the co-operation of the other survey parties. They all joined heartily in the transportation arrangements and worked from early morning until late in the evening. I have much pleasure in moving a vote of thanks to Mr. Seibert.

MR. FINNIE: I am sure that we have all enjoyed this address very much. I went down in July and met the field parties. They had travelled 4000 miles in two and a half months which was remarkable in consideration of the difficulties encountered. The pictures were splendid and what especially interested me was the fact that they showed so much water power along the rivers, and if oil is struck in any quantity in that country it suggests a means of delivering it to points south. We have all enjoyed the pictures very thoroughly and I take great pleasure in seconding the motion of Mr. Narraway.

THE CHAIRMAN: I have much pleasure in extending to Mr. Seibert the thanks of the meeting for his very excellent address.

After the discussion on Mr. Seibert's paper the President called the meeting to order and read the report from Messrs. Rannie and McElhanney of the election of officers:—

President—G. H. Herriot, Winnipeg.
Vice-President—D. H. Nelles, Ottawa.
Secretary-Treasurer—W. L. MacIlquham, Ottawa.

Councillors—
  Ottawa—J. W. Pierce,
    B. H. Segre,
    A. M. Perry,
    J. E. R. Ross,
    T. H. G. Clunn.
  Quebec—E. F. Gorman, Buckingham.
  Ontario—E. P. Bowman, West Montrose.
    F. W. Beatty, Pembroke.
  Sask.—W. M. Stewart, Saskatoon.
    W. R. Reilly, Regina.
  Alberta—H. E. Pearson, Edmonton.
    J. B. Alexander, Calgary.
  B. Columbia—J. E. Umbach, Victoria.
    E. C. Coursier, Revelstoke.

Manitoba—W. E. Hobbs, Winnipeg.
C. E. Joslyn, Winnipeg.

It was moved by Mr. Rannie, seconded by Mr. McElhanney, that the ballots be destroyed. Carried.

MR. HENDERSON: I would like to call on the newly elected officers to say a few words. I should like to hear from Mr. Herriot, our new President, with regard to the policies for the coming year.

MR. HERRIOT: Mr. Chairman, Gentlemen, I can hardly find words to express the pleasure that I feel on this occasion. I do feel, however, that the nominating committee might have acted more wisely had they put another name on that list along with mine. It appears as though the nominating committee had actually elected me. While I feel the honour that the nominating committee has conferred on me still I do not feel that it is the entire sentiment of the D.L.S. Association. In that connection this amendment to the by-laws that we are going to consider to-day will perhaps do away with such a thing as this happening in the future. Until this winter I had never had the good fortune of meeting Mr. Bridgland and a great many other members of the Association had never had that good fortune. Your nominating committee a year ago placed Mr. Bridgland's name on the ballot along with my own and as Mr. Bridgland was not known widely to you surveyors, unfortunately he was not elected. After listening to him this morning I am convinced, gentlemen, that you made a very grave mistake but Mr. Bridgland has himself to blame for not being here before.

In regard to the policies that Mr. Henderson has suggested I think the Association has been running along very nicely as it is, that is it has been going into hibernation for practically the whole year, only coming out for its Annual Meeting. Well that is a pretty comfortable situation but I do not think that this organization should be content with that. I think we ought to become more active. In fact we have become so inactive that the Topographical Surveyors Society or some members of it think that society is the only organization we surveyors have. So long as the D.L.S. Association continue to hold but one meeting in the year I think we will have difficulty in removing that impression from their minds. To make this possible I think we should have some other meetings during the year and I see no reason why we should not have a public meeting at least once during the year with some prominent speaker. We have among the D.L.S. members some very prominent men, who at some time or other might be in Ottawa and I am quite sure we might be able to get them to address us. I have reference to two men especially, Mr. C. A. Magrath and J. S. Dennis, both prominent men and men who would be sure to draw an audience.

Some of the members of our Association had the good fortune to be present at a dance held by the engineers in the Chateau Laurier about two weeks ago and as a result we are thinking seriously along the lines that we should emulate the movement made by the engineers and I believe if you gentlemen give serious thought to such a plan we might hold a dance at the Chateau Laurier next year at the time of our Annual Meeting. I think a little propaganda work may be necessary but the idea is given to you that you may plan along that line and give the executive what backing they need.

I feel a little nervous in mentioning this point, but in looking over the Annual Meeting of yesterday and to-day, especially yesterday, when the Committees reported, I think that when a committee is appointed to cover a certain field of work that committee should not lie dormant until the day before the Annual Meeting and then start to prepare a paper for the next day. Unless we put our best efforts into the work we are undertaking we are not going to get very far ahead. The reports submitted yesterday are an example of how we can fall down on our work.

These are all the points that have come into my mind for the present. I again want to thank you for the honour you have conferred on me.

The question of the amendment to the by-laws was then taken up and discussed.

It was moved by Mr. Akins, and seconded by Mr. Rannie, that the amendment to section 7 be changed to read as follows:

"The officers of the Association shall consist of a president, THREE VICE-PRESIDENTS, two to be elected from members resident in Ottawa, one of whom shall represent a minority group, and one non-resident member, a secretary-treasurer......" Carried.

MR. RANNIE: With regard to fee, I should like to know what has to be done to have them reduced.

MR. BLANCHET: You have to give a notice of motion before the next Annual Meeting and it will be open for discussion at that Annual Meeting but would not come into effect until the following year.

Mr. Martindale moved that the usual honorarium be granted the Secretary. Mr. Akins seconded the motion. Carried.

MR. SEIBERT: I do not think that we should close this meeting without instructing the Secretary to write a letter to the Director of the Geological Survey to express our appreciation of his courtesy in allowing the Association the use of this auditorium for our meetings.

EVENING SESSION—THURSDAY.

THE CHAIRMAN: I have much pleasure in introducing to you Mr. Wilson of the Air Board. We are fortunate in having an opportunity of hearing the policies and activities of the Air Board outlined by one so competent of presenting them as Mr. Wilson.

THE WORK OF THE AIR BOARD.

By J. A. WILSON.

Secretary of Air Board.

The Air Board was created by Act of Parliament in 1919 for the control of aeronautics in Canada. It has three functions—

(1) Control of Civil Aviation;
(2) Conduct of Civil Government Flying and
(3) The Air Defence of Canada.

It is therefore divided into three Branches, each dealing with one of these functions. A common Departmental organization has been formed to serve all three. This includes Technical, Equipment, Records, Accountants and Intelligence Services.

Time will not permit of my dealing, in detail, with all phases of the work. As the conduct of Civil Government Operations is the phase which interests your Association most I will confine my attention to it and must pass over the other two functions in a word or two.

Commercial Aviation.

Up to the present there has been no great development in Canada of commercial aviation. Financial conditions have been adverse. The absence in Canada of large centres of population such as they have in the United States and Europe makes the establishment of Air Mail and Passenger Services difficult. Rapid means of inter-communication is an essential of modern civilization and aerial transportation will gradually take its place among the ordinary methods of communication all over the world. Before the advent of Railways, Confederation would have been impossible and the Intercolonial and Canadian Pacific Railways were built as part of the agreement for union between the different provinces in Canada. In the future a trans-continental journey will take 48 hours or less and Halifax will be six hours from Montreal, instead of 30 as at present.

There are to-day about 30 firms engaged in commercial aviation in the country. They are making a brave struggle against adverse circumstances and their efforts to promote flying are worthy of all praise. These companies have made about 8000 individual flights during 1921, covering a distance of about a quarter of a million miles with a loss of one passenger killed and one injured. The public still considers flying a somewhat risky method of transportation. This is not necessarily the case, however, as most of the accidents which occur are due to trick and stunt flying. This has now been prohibited by the Air Board as it served no useful purpose. Flying under favourable circumstances is a comfortable, quick and interesting method of transportation

Though costly at present, improved machines and engines will gradually bring it within the reach of those who desire, for any reason, a much quicker method of transportation than our present railways, motor cars and steam boats provide.

Air Defence.

The Air Board was formed after the War with Peace conditions in view. It was, therefore, primarily formed as a civilian organization. Defence, however, was not forgotten.

The Act provides for representatives of both the Army and the Navy being members of the Board and sharing in the general control of aviation. It was felt that the country, under the conditions then existing, could not afford, and was not justified in maintaining, an expensive permanent Air Force. It was desired to retain advantage of the skill and experience gained by so many Canadians during the War and made it available, through the C.A.F., for service in time of emergency. A school of Aeronautics was therefore established at Camp Borden to which all those who had served during the War in the flying services could be sent for re-fresher courses periodically. Instructional and administrative staffs are appointed for terms of about six months from officers with special qualifications. The curriculum incudes, besides flying, ground instruction, administration, photography, wireless, armament, air navigation and other necessary subjects. During the past 15 months 500 officers and 1100 men have taken the course at Camp Borden. We thus obtain, at a minimum expenditure, the largest number of trained officers and men, who though normally engaged in civil occupation, are available for service should they be required.

It is significant that at the recent dis-armament Conference in Washington, the Great Powers after consideration decided that it was impossible to place any limitation on aircraft for the reason that commercial machines could be used for War purposes. Civil Aviation must, therefore, be considered the great reserve for Air Defence. It follows that there is perhaps no simpler or more efficient way of strengthening the Defence organization of the country than the encouragement along proper lines of civil aviation.

Civil Government Flying.

With these few words on the other two phases of the work we must pass to the Civil Government operations. It was recognized that there was in Canada a large field for useful operations in the remoter and less accessible parts of the country in connection with forestry work, surveying and transportation. In such work men and machines could profitably and usefully be employed in time of Peace and would form an immediate reserve in time of Peace and would form an immediate reserve in time of emergency. The Civil Operations Branch was, therefore, formed and thanks to the support of Forestry Branches and other Services interested in the development of the country, the Air Board has been able to maintain this Branch and increase it materially during the past season in response to the many urgent demands for flying services from all over the country. The slides which will now be shown will, it is hoped, give a general idea of the work accomplished. Each station will be illustrated separately.

Vancouver Station.

The work at Vancouver, as at most of the other stations, is mainly forestry work. The Provincial Government is keenly interested in the Station and makes extensive use of its facilities. They have defrayed a substantial part of the cost of operating the station. The range of operations covers the whole of Vancouver Island and reaches as far into the interior as Revelstoke. Flying makes it possible for those in charge of forces scattered over a large area to keep personally in touch with the work in a way it is not possible by present methods of communication. Then can visit within 24 hours the most distant camps or stations and see for themselves the actual conditions under which work is being carried out. It gives the administrator control of his forces and reliable, up-to-date, information which should increase the efficiency of his service. As an instance of this—a heavy gale destroyed a quantity of very valuable timber on the West Coast of Vancouver Island. The District Forestry Officer was able in two days' flying to cover the whole territory, see for himself and bring back pictures of the actual damage done. This, without a flying boat, would have taken many months of work and ground work would not have given the same clear general idea of the situation. Fire patrols are carried out during the season of fire hazard in the railway belt for the Dominion Government and in the Coastal regions and over Vancouver Island for the Provincial Service. Another interesting operation was that undertaken for the Geodetic Survey. Mr. F. H. Lambert of that Service was engaged in Primary Triangulation work. By using flying boats he was able to locate his triangulation points over a territory three times as large as he would have been able to cover by ordinary ground methods, with infinitely less labour and at a considerable saving in cost. Much work has been done, in addition, for the Customs Department in the prevention of Drug smuggling; for the Entomological Branch, Department of Agriculture, in the survey of musquito breeding areas in the Nicoamen District; and for the Fisheries Branch in the prevention of illegal fishing and inspection of Fish Hatcheries.

High River, Alta.

Passing East to Alberta, the Air Board has established a station, primarily for the protection of the forest reserves on the eastern slopes of the Rocky Mountains, from fire. The aerodrome at High River lies on the edge of the Prairie, close to the Foot-hills. Wireless communication between the aerodrome and machines is maintained and the observer on patrol can communicate the location of any fire spotted without loss of time to the officers of the Forestry Service. The protection of these forests is essential to the welfare of the Prairie Provinces as the rivers which flow through the Prairie take their rise in the mountains and foothills in the reserve. Fire patrols reach as far north as the Clearwater River and as far south as the International Boundary. Daily trips are made over this territory during the season of fire hazard. At the request of the Parks Branch Department of Interior, a machine was sent to Jasper Park and there carried out two days flying. During this time the Park Superintendent was flown over territory previously unexplored and was able to gain more information in two days than he could possibly have done by pack trail in the course of several months. Another interesting phase of the work done from High River was the obtaining of urgently required information for the International Joint Commission regarding the nature of the country at the head waters of the International streams in Southern Alberta. Eight days after receiving the request, photographs showing clearly the district and the natural conditions were made available in Ottawa for the Commission.

Victoria Beach, Man.

We must now pass East to Lake Winnipeg. The country here is entirely different and very suitable for the operation of flying boats. It is a flat country with many lakes and rivers. The work here has almost entirely been for the Forestry Branch, Department of Interior. Fire patrols were previously carried out by canoe route and owing to the flat nature of the country and the great distances to be travelled this method of patrol, though the best which could be devised before the advent of the flying boat, was inefficient. Daily patrols cover the district adacent to the south end of the Lake where the fire hazard is greatest. A weekly patrol passes over the forests on the Eastern shores of the Lake as far north as Norway House, thence across the North end of the Lake and through Lake Winnipegosis to the town of that name and then across the territory between Lake Manitoba and Lake Winnipeg, back to the base. This patrol covers 750 miles more or less and takes a day and a half to carry out. In the opinion of the Forestry Officers this method of patrol will entirely supercede the canoes and motor launches now used in the district.

Flights to Cumberland House, Le Pas and the Carrot River Triangle were undertaken. Engineers of the Reclamation Service were taken for flights which enabled them to obtain a grasp of the situation as a whole which they could not otherwise get. Much other useful york for Government services operating in that territory was undertaken.

Sioux Lookout, Ont.

The work from Sioux Lookout was carried out at the request of the Forestry Department of the Ontario Government who desired to obtain information in regard to the Forest areas north of the Trans-continental. The Provincial Government defrayed half the cost of this operation and sent their Forestry Engineers to conduct the forest survey. A district of approximately 200 miles east and west and averaging 50 miles north and south was surveyed during the flying season. The engineers made a map of the whole district showing the lakes, barrens, muskeg, etc., and sketched in on the map the forest types. Work from the air was checked by ground cruises and many photographs were taken to substantiate their results. The Ontario Government have expressed themselves as being entirely satisfied with the result of the season's operations. As a proof of this they have asked the Air Board to undertake next summer, on a repayment basis, four times as much work as was done last year.

Roberval, Que.

The Station at Roberval on Lake St. John was established in 1920 with the co-operation of the Provincial Government of Quebec who are keenly interested in the work. Their Forest Service directs the work and machines are at their disposal for fire patrol, survey, and transportation as necessary. The work has been carried into the almost unexplored district north of Lake St. John as far as Lake Mistassini, where petrol caches have been established with a view to extending the work even farther north next season.

Halifax, N,S.

This station was built during 1918 for anti-submarine patrols. No large operations have been carried out from there and it is used largely as a repair and maintenance depot for flying boats. Several interesting small photographic operations have been undertaken, including work for the Geological Survey and the International Boundary Commission.

Ottawa, Ont.

This combined seaplane station and aerodrome was established in 1920 primarily for research and experimental work. It has been used for many practical and interesting operations of great value. The development of a camera for aerial survey has been undertaken under the direction of Dr. Deville, the Surveyor General, to whose encouragement and interest the Air Board owes much. A complete set of mosaics has been made of the sites of the proposed works for the development of power and the improvement of navigation on the St. Lawrence River. The International Joint Commission at whose request this was done are very pleased with the results which they state will be of direct practical value to their engineers. By placing on one slide a section of the mosaic with an ordinary plan of the same ground, a good comparison of the two methods is obtained. It is interesting to compare the results in detail. The photograph has clearly many advantages over the plan as it shows the actual conditions and can be read by a layman with ease. Thanks to the enthusiastic co-operation of the survey branches much progress has been made in the development of aerial photography. Its use in connection with city work is specially valuable and mosaics have been made of Ottawa, London and Vancouver. These have been found of great value in Town Planning and City Survey work. Another interesting operation done from the Ottawa Station was 10 days flying in the Timiskaming region for the Entomological Branch, Department of Agriculture. They wished to investigate the damage caused there by the Spruce Bud Worm. In 10 days flying their Entomologist was enabled to cover a very large tract of territory and obtain full information on the situation. For this class of work flying has tremendous advantages and increases its efficiency very greatly.

Ladies and Gentlemen:

I am afraid that I have already kept you too long. I hope, however, that what I have said and the pictures which have been shown have given you some idea of the work the Air Board has done during the past two years. Our endeavour has been to work along useful lines. We wish to get down to a sound business basis and be more or less self-supporting. In Northern Canada there is a very great field for aerial transportation. The distances are so great, and present methods of transportation so slow that flying will hasten its development. Air Services will enable those working in that country to to lengthen their season, work under better conditions, receive occasional mails and make reports to their Headquarters. It should increase their efficiency enormously and should lessen the burden of toil on the scientific men who, under present conditions, spend more than half their time as canoe men and packers.

The work of the Air Board has been carried on in many cases under disadvantageous circumstances. It is still largely in the experimental stage. We have had to use War machines, many of them obsolescent and unsuited for our purposes. We have no permanent buildings and most of the work has been done on the banks of lakes and streams without workshops, slipways or hangars. The results achieved so far are due to the energy and resource of our flying officers and mechanics. It is of the same high standard as their work overseas in the War. Canada has no finer body of men in its service. The progress already made encourages us to hope that with better machines and more experience the Air Board will be able to build up a sound useful service, largely self-supporting in time of Peace, and suitable for the purposes for which it was created. Defence, Civil Government Operations and the Control of Civil Aviation.

LAKE BEAUVERT

The mountain on the extreme right is Roche Bonhomme. On the left is Hawk mountain, and a little to the right the summit of Colin mountain.

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ASSOCIATION OF DOMINION LAND SURVEYORS

Members.

NAME. ADDRESS.

Alexander, J. B.—7 Thomas Block, Calgary, Alta.
Akins, J. R.—Topographical Surveys Branch, Department of Interior, Ottawa.
Atkins, C. B.—436 Park St., North Vancouver, B.C.
Bigger, C. A.—Geodetic Survey of Canada, Department of Interior, Ottawa.
Bayly, Gilbert St. J.—Topographical Surveys Branch, Department of Interior, Ottawa.
Beresford, H. G.—859 Ingersoll, St., Winnipeg, Man.
Beatty, F. W. — Topographical Surveys Branch, Department of Interior, Ottawa.
Bartley, T. H. — Topographical Surveys Branch, Department of Interior, Ottawa.
Blanchet, G. H.—154 Bay St., Ottawa, Ont.
Burchnall, R. P.—Rimbey, Via Lacombe, Alta.
Benner, F. J. .—Ruttan Blk., Port Arthur, Ont.
Bayne, G. A.—c/o Hudson Bay Co., Land Dept., Winnipeg, Man.
Bannister, G. W.—482 Bronson Ave., Ottawa, Ont.
Begg, W. A.—Dept. of Municipal Affairs, Regina, Sask.
Baird, W. J.—18 Hurndale Ave., Toronto, Ont.
Bridgland, M. P.—Topographical Surveys Branch, Department of Interior, Ottawa.
Barber, H. G. — Topographical Surveys Branch, Department of Interior, Ottawa.
Bowman, E. P.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
Berry, E. W.—Room 7, Thomas Block, Calgary, Alta.
Bennett, G. A.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
Boulton, W. J.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
Bray, Samuel—Department of Indian Affairs, Ottawa.
Brenot, L.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
Browne, E. F.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
Cordukes, J. P.—Geodetic Survey of Canada, Dept. of Interior, Ottawa.
Cumming, A. L.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
Cowper, G. C.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
Cram, A. S.—Land Patents Branch, Dept. of Interior, Ottawa.
Carthew, J.—P. O. Box 40, Mountain Park, Alta.
Currie, P. W. — Topographical Surveys Branch, Department of Interior, Ottawa.
Calder, J. A.—Ashcroft, B. C.
Christie, Wm.—1825 1½ Ave., W., Prince Albert, Sask.
Clarke, R. F.—R. R. No. 1, Jordan, Ont.
Cautley, R. W.—523—6th St., Edmonton, Alta.

Clements, F. S.—Prince Rupert, Box 49. British Columbia.
Coltham, J.—Box 264, Aurora, Ont.
Cameron, M. G.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
Cochrane, M. F.—Dominion Water Power Branch, Dept. of Interior, Ottawa.
Clouston, N. S.—82 Burbage Road, Herm Hill, S.E. 24, London, Eng.
Coursier, E. C.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
Davidson, R. D.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
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Ferguson, G. H.—Commission of Conservation, 916 Drummond Bldg., Montreal, P.Q.
Fewcett, S. D.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
Fullerton, J. T.—1945 Ash St., Victoria, B.C.
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Gorman, E. F.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
Garner, A. C.—Chief Surveyor, Land Titles Office, 2133 Cameron St., Regina.
Galletly, J. S.—30 Harvard Ave., Toronto, Ont.
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Gorman, A. O.—Topographical Surveys Br., Dept. of Interior, Ottawa.
Glover, A. E.—12220 Stony Plain Rd., Edmonton, Alta.
Gibbon, Jas.—1631 Collingwood St., Vancouver, B.C.
Hawkins, A. H.—Soils Laboratory, University of Saskatchewan, Saskatoon.
Hardouin, Jos.—Topographical Surveys Branch, Dept. of Interior, Ottawa.
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Stewart, A. G.—Office of the District Surveyor and Eng., Dept. of Public Works, Edmonton, Alta.
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Teasdale, C. M.—36 Churchill Ave., Toronto, Ont.
Tyrell, J. W.—7 Hughson St. South, Hamilton, Ont.
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Watt, G. H.—Topographical Surveys Branch., Department of Interior, Ottawa.
White, Russell—205 Fifth Ave., Ottawa.
Whyte, H. E.—532 Linden Ave., Victoria, B.C.
Wrong, F. H.—Topographical Surveys Br., Dept. of Interior, Ottawa.
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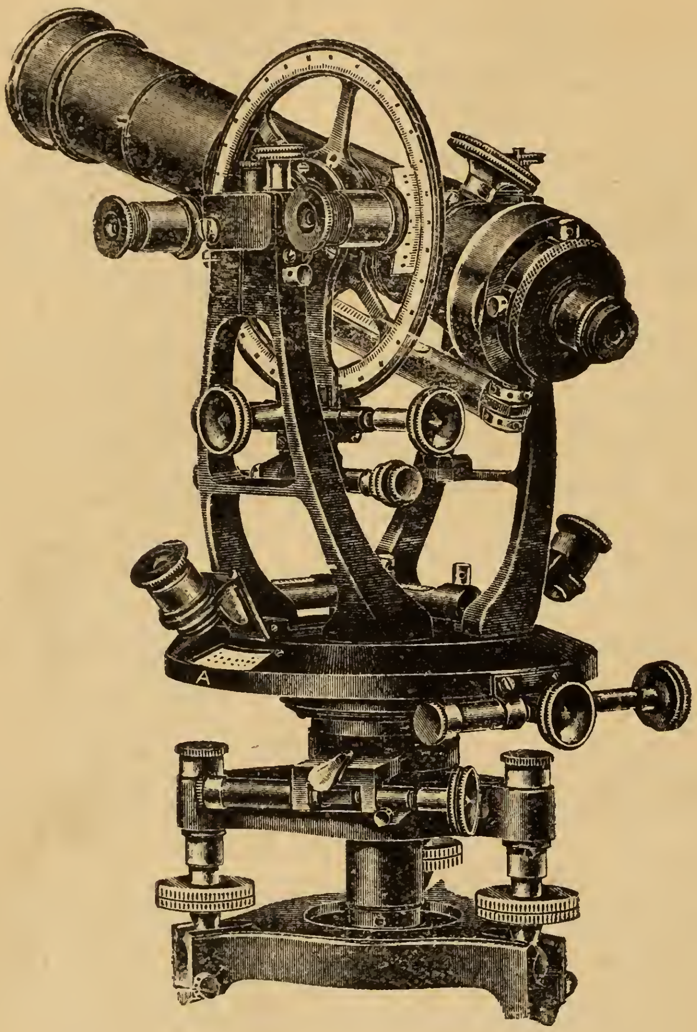

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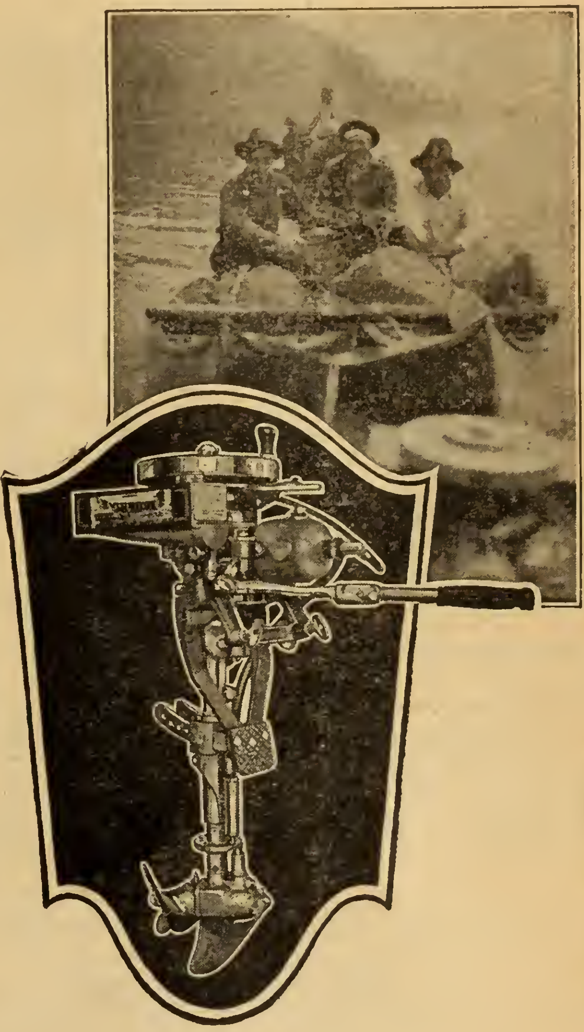

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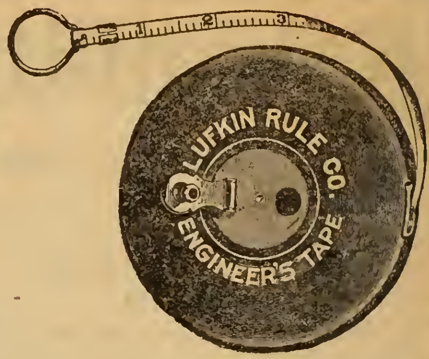

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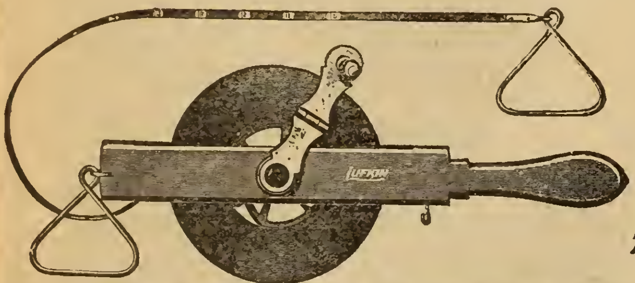

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